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FOOD TECHNOLOGY

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FOOD TECHNOLOGY

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THE FIRST MILESTONE

With this issue, we reach the conclusion of Volume 1 of the official journal of the Institute of Food Technologists. The editors and publisher wish to express their appreciation of the splendid reception of the journal by the Institute membership, as well as by others.

The antecedents of FOOD TECHNOLOGY were six volumes of I. F. T. Proceedings, the first five of which covered respectively the food conferences held in Chicago in 1940, Pittsburgh in 1941, Minneapolis in 1942, St. Louis in 1943, and Chicago in 1944. The sixth volume of Proceedings contained the technical papers of the program that was arranged for presentation at the Sixth Annual Meeting of the Institute of Food Technologists, which was not held because of a transportation ban imposed by the Office of the War Mobilization Director.

In this issue, two new departments are inaugurated, which the editors believe will be of interest and value to our readers. Under the heading "Current Patents and Patent Litigation," Mr. A. J. Nydick, 225 Broadway, New York 7, New York will discuss in each issue some phase of patent law or usage which is of interest to food technologists. In the present issue, Mr. Nydick gives an illuminating interpretation of the phrase, "flash of genius," which has figured prominently in certain court decisions. The department, "Industrial and Legal Viewpoints," will contain discussions of control regulations and laws, of relationships between industrial management and research or technology, etc. Dr. F. N. Peters' article in this issue presents, in unmistakable terms, an industrialist's view on questions bearing upon federal standards of identity.

An index of Volume 1 will be contained in the final pages of Volume 2, No. 1, to be issued in January, 1948.

ATTENTION, AUTHORS

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editors' office a copy of a booklet, titled "Suggestions to Authors," and see that their papers are in the form specified therein before they are sent to the editor.

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FOOD TECHNOLOGY

VOLUME 1 OCTOBER, 1947 NUMBER 4

Editorial

Value of Industrial Research Institutes to Food Technology*—W. L. Campbell

In this paper, I shall review the cooperative methods that might be open to the food industry to carry forward planned research more economically.

Let us first consider a few generalities on the subject of industrial research. Sir Edward Appleton, Secretary of the Department of Scientific and Industrial Research in England, a department that controls the government-sponsored research program in that country, gave the Arthur D. Little Lecture at the Massachusetts Institute of Technology during this past school year. He told a story that epitomizes some peoples' ideas of research. Two partners in a small English Company decided that they should have a research program. So they hired a fresh young graduate from Oxford, bought a supply of miscellaneous test tubes and beakers, a few bottles of acids, and a white coat for the young man. On Monday morning they showed him his new quarters in a small back room, and then they went to the front office to open the mail. About 10 o'clock one partner said to the other, "John, don't you think we had better go back to see what the young man has invented?" The other partner replied, "I think it would be fairer to wait a little while; let's give him until noon."

There is no short route to Heaven. Various schemes have been tried to package research, like ice cream, in order to have it available for the small organization in a wide variety of flavors, ready to take home whenever "company" should come to visit. The fervor for this type of research often lasted about as long as a dish of ice cream.

The New England Council tried a community plan for the small manufacturer under the title of the "New England Research Foundation," without a separate laboratory. This foundation was under the able direction of Dr. L. W. Bass, formerly the second-in-command at Mellon Institute and now the Head of Research for the Air Reduction—U. S. Industrial Alcohol group. Certainly the auspices were most favorable, and yet the plan has been dropped. In such a community program for research, unless you set up a fully equipped laboratory where you more or less compete with the commercial consulting laboratories, the work either tends toward that of an Assistant Secretary of the Chamber of Commerce, or you finally have a few people who want to monopolize the work without corresponding contribution.

If any industrial company, large or small, is genuinely interested in research, the only real solution is for it to go to the expense of a research department, even if this department comprises only one man. Then additions can be made to the results obtained from the company's own research department by contacts with other outside agencies, such as commercial research laboratories, research institutes such as Mellon Institute, Boyce Thompson Institute, or Battelle Memorial, or community groups like those of Birmingham and Kansas City, and research departments in universities, who are working in fields of investigation for which they are particularly fitted. However, any company needs its own staff to keep at maximum efficiency

* Presented before the Seventh Annual Food Conference, Boston, Mass., June 2, 1947.

the research carried on for it outside, to correlate with its own needs the results obtained by such outside agencies, and to make the necessary future improvements that come with use of a new development.

Once I sold machine tools, and it was my experience that there was never an instance where we designed a machine tool and the jigs or fixtures with it for a particular job but that, after the equipment was put into use, the purchaser's own employees could suggest worthwhile improvements. The same experience will be encountered in other processes and is what we should naturally expect, for employees know the company's operations better than an outsider and, being given an idea, can adapt it to their particular use.

I have personally, in small, medium sized, and large companies, made use of the research facilities mentioned and have found that they all have their place. For instance, for a company that ordinarily employed two people in its laboratory I engaged the service of an outside commercial consulting laboratory to determine the effect of pH on the dyeing of leather with various types of dyes. After the work was laid out and the technique established by the consulting laboratory, our own force could carry on the research and apply the technique to our own process.

Another entirely different example is the cooperative work by the Kroger Company and the Westinghouse Company carried on at Mellon Institute on the tenderizing of meat. In this case, facilities were available at the Mellon Institute which neither of the sponsors had in its laboratory. Each company contributed its specialized knowledge, which would not have been available to the other, had either one done the job alone. And the result was the development of a highly satisfactory process, well worth the time, effort, and money spent on it.

Still another example is the cooperative research work at present being carried on in the Department of Food Technology at Massachusetts Institute of Technology. With one group of sponsors we are studying dehydration, sterilization, packaging, and flavor. Facilities are available here that are beyond even the equipment budget of individual sponsors, large as such budgets may be. We have a personnel with specialized training in the particular subjects. Then, through the cooperative effort, the combined knowledge of the group is applied to the solution of the problem. The result should be the maximum return, for the minimum expenditure of money. I shall refer to this again later.

Many companies, employing a large number of people in their laboratory and the research department, are still not doing much real research. Actually they are chiefly engaged in "trouble shooting," both in their own operations and for their customers. So when one of these problems arises, all hands are commandeered to drop everything else and concentrate on the difficulty, much to the dislocation of any research program. Therefore, a cooperative arrangement with some outside organization, be it a commercial research laboratory, an industrial research institute, or a university, furnishes an opportunity for such a company to allocate at least a part of its expenditure to future prospects without interference, no matter how important the "trouble shooting" may be.

Universities, as well as a portion of the laboratories of some of the largest industrial companies, are always engaged in pure research, which is the first step in industrial progress. The next step is the application of some of this pure or basic research to current industrial problems. Close contact with the Science and Engineering Departments of the leading universities will enable a company to be the first to hear about a new development. Mr. Julius Rosenwald, when President of the Sears Roebuck Company, said that all he wanted was one year's headstart on

his competitors. Amongst the New York Garment Trade the same idea is expressed in another way; a preferred creditor is defined as one who learns about the failure first. This advantage of first-hand information about research developments shows why industrial companies, if they desire to hold the lead among their competitors, can well afford to spend a portion of their research budget on such cooperative investigation. Indeed, after one understands the current working of such a cooperative research plan, one can hardly imagine how any leading industrial concern could afford not to participate in such a program.

Frequent contacts between the universities and the industrial research organization are good for both sides. On the side of the universities, this contact keeps them informed of current practices in industry, furnishes the encouragement of practical application of scientific findings, and makes them that much better equipped for student instruction, which is the primary purpose of the educational organization. For industry, this contact keeps the company abreast of the current developments in basic science, enables it to keep an eye on an excellent source of recruits for its operations, both among the students and the younger technologists in the more advanced grades, and gives a chance for its own organization to secure the leaven of an excellent outside contact. Industries that are willing to pool their interests in such sponsorships may be surprised that the costs involved for each may be no greater than the maintenance of one or two good men under their own roof.

Now the food business is no different from any other business in needing research. By some, the advances made in the food industry are said to be backward compared with the advances made, for example, in the electrical field, the metallurgical field, or the chemical field in the last twenty years. However, many of these advances in the other fields are applicable to food processing. Because of the importance of food to our general welfare in this country and because of the position of food as the main factor in peace now throughout the world, we should certainly bring to bear all the knowledge that can be concentrated into getting more abundant, nutritious food into the hands of the consumer at the most economical price and in the best protective packages.

Let us look at some of the developments in the food industry. First, we see the great improvement in mechanical farming and agricultural production. The operations of the Hawaiian Pineapple Company are a good example. Every operation that can be mechanized is so done. In addition, new methods have been adopted, like contour plowing, flame weeding, and aeroplane dusting. Science has produced soil fumigants against nematodes and other pests, new fertilizer to give higher yields, hormones to insure ripening at the proper time in peak condition, and chemical insecticides like DDT for wide control of insect pests. Some of these results have been accomplished by the cooperation of the entire pineapple industry through the Pineapple Research Institute. Others have come about through cooperation between individual companies in this industry with commercial suppliers, and a sponsored project on flavor has been carried on at the California Institute of Technology.

After any crop is grown, even under ideal conditions, this solves only a portion of the problem of getting food into the hands of the consumer economically, in abundant supply, and while the food is still of good quality. The harvesting of the crop with the least labor is always a stimulating problem. The present combine in a wheat field in contrast to the methods used in this country prior to 1850 shows what can be done. We need to remember only that not much real progress had been made in mechanizing the wheat harvesting operations from the dawn of history, when wheat was first grown for food, down to the time of Cyrus McCormick's

invention, to realize the great strides that have been made in such mechanization in recent years.

In the next stage, processing, we might cite an example. The mixing of bread was approximately the same hand operation from the early manufacture of bread until mechanical mixers were introduced, around 1900. A recent advertisement of a brewery mentions 5000 B. C. as the earliest date of beer manufacturing, and bread was certainly made before that. In view of the record, therefore, the food industry too has made noteworthy advances in the twentieth century.

Today one of the most interesting developments in food processing is the mechanical harvesting and prompt preparation of the produce by chilling, washing, sorting, and packaging, so that the produce reaches the customer in peak condition. When my father was a child on the Illinois prairie, an orange was such a rarity that he was surprised by the gift of one as a Christmas present. Yet today citrus fruit reaches the smallest hamlet in this country as a regular article of commerce, like sugar or coffee, thanks to the advances made in harvesting, packaging, refrigeration, and transportation.

The research on the individual packaging of fresh food products offers a means of getting the top produce to the customer without waste and with minimum further preparation required. The quick frozen food product was developed for this reason, and the processor in this field must realize that top quality in this product is the reason for his existence. But individually packaged fresh foods and quick frozen foods have, as competitor, canned foods, and we should not expect that purveyors of this latter commodity would stand still and let the procession pass by them. This competition should lead to the ultimate goal for which we are all striving, namely, the development of the best process necessary to preserve food in all its natural flavor for a reasonable length of time.

In this consideration of food preservation, I might cite as an example of industrial cooperative research the study now being carried on at the Massachusetts Institute of Technology on sterilization without heat. We are all acquainted with the Sterilamp and the bactericidal effect of its emanations in the ultra violet range. The maximum bactericidal effect of this lamp is at a wave length of 2537 Ångström units. It has been our study at the Massachusetts Institute of Technology to find out whether electromagnetic radiation in various forms in other ranges would not be of value for sterilization without heat. The wave length of 2537 Ångström units corresponds to a frequency in the range of 10^{15} cycles per second. The operational range of radar at present is 10^{10} cycles per second. Even if a sub-harmonic of this lethal wave might be found in the lower range now attainable by electronic methods, yet the power expended would make this an uneconomical method of sterilization. The vibrational effect of high frequency also means rapid heating. This is shown by the Radarange, of which you will see a demonstration this evening. True, this heating has a selective effect, depending on the relative dielectric constants and moisture content of the material being vibrated, but the result is sterilization with heat and not without heat.

Let us consider some of the effects of vibration in the lower ranges, namely, with supersonic and sonic frequencies. Here we get a bactericidal effect when we have cavitation. However, this bactericidal effect appears to follow the same pattern as that noted when flies are killed in a dark room with a fly-swatter. The early blows reduce the population rapidly, but considerable effort is required to kill the last fly. Similarly, the prolonged vibration required in sonic or supersonic range generates heat, which is the thing we wish to avoid. Sonic and supersonic

vibrations can be used with profit in food processing, but as a sterilizing agency they do not appear to furnish the complete answer.

Next we have investigated X-rays and cathode rays as an answer to the problem and, for any bacteria so far tested, we have been able to get complete sterility with 1,500,000 Roentgen units, which with our high voltage equipment can be secured in 10 minutes by X-rays or in less than that number of seconds by cathode rays. The use of these rays follows the same law previously mentioned of an exponential curve, namely, that for 10 per cent of the energy expended the kill amounts to 99 and a fraction of a per cent but that the remaining 90 per cent of the energy is required to kill the last fraction of one per cent of the bacteria. Nevertheless the action is rapid enough to avoid any appreciable heating of the medium. Similar results are obtained both with X-rays and with cathode rays. The X-rays give great penetration but low efficiency in production of X-rays for the power input. This efficiency increases with increase in voltage, so that at 2 million volts the efficiency is much more than twenty times that at 100,000 volts. The cathode rays give the maximum efficiency for the power input but have low penetrating quality, corresponding to about 1 centimeter of water at 2 million volts. The penetration in other media is inversely proportional to the specific gravity of the media in relation to water.

Granted that we can obtain sterility by this method without heat, what are some of the other effects? First, we find that differences in the pH of the media have practically a negligible effect on the killing power of the rays. As to the enzymes, it appears to take more than ten times the power to inactivate the enzymes we have tested than it does to kill the bacteria. Hence a selective effect is possible, but it appears at present that this is not by any means the most economical way to inactivate enzymes. What is the effect of these rays on vitamins? That can be determined only by further study. It would be expected that those vitamins that are subject to oxidation might be affected. Preliminary experiments on citrus juices indicate a maximum diminution of 10 per cent in content of vitamin C by this X-ray sterilization. Many other factors remain to be studied. We must study also the effect of these rays on color, texture, and taste, which may be determining factors in the ultimate potentialities of such a sterilization method balanced against expense.

These studies give a striking example of the value of such cooperative research groups. Massachusetts Institute of Technology had the high voltage generators developed in the departments of Physics and Electrical Engineering for use in experimental nuclear physics and in some therapeutic work. Coupled with these electrical instruments was equipment for spectroscopic work. There were specialists in all the equipment, as Dr. Van de Graaff and Dr. Trump are presently concerned in building a 12 million volt generator. There was also a cooperation between departments immediately at hand, which is so necessary for best results. If we in Food Technology had problems in physics, chemistry, biology, electrical engineering, mechanical engineering, or chemical engineering, we had only to call on the specialist in that other department for help, and it was forthcoming.

Finally, I cannot speak too highly of the cooperation we have received from our sponsor industrial group. They have checked our tests, furnished us with particularly resistant strains of bacteria, prepared raw material for us, consulted with us on methods, helped in the selection of features that would give the most interesting results, and have been generous of their personnel to work with us. I can only hope that with the more adequate facilities we now have and with some of the early handicaps overcome, we can make progress faster.

Editorial

We wish all sorts of success to our sister institutions, like the University of Illinois, the University of Chicago, and the University of California and others, in their efforts to advance similarly the art of Food Technology, which certainly offers a bright future.

Under such circumstances, whether in colleges, research institutes, or large commercial laboratories, where similarly fortuitous combinations of facilities and personnel exist with the will to work cooperatively and harmoniously, certain types of research problems can be financially aided by industry to the very distinct advantage of industry itself from the standpoint of funds invested.

The bridge between such research centers and the food industries is one that many executives and members of management in the food industry should travel in the future with mutual advantage to all concerned. To those who do travel this bridge, vistas of future events will sometimes be sufficiently clear to point the trends that may benefit their organizations in the years to come.

Editorial

Scientists Will Run the Farms

We acknowledge credit for the above title to an Ohio farmer, Louis Bromfield, who used it for his syndicated column on August 30, 1947. Mr. Bromfield's theme was that the successful farmer today is a specialist, who focuses all of his attention upon a small number of specialties. High production yields of these specialties spell success; the attainment of high yields is a job for scientists.

Almost daily a report by mail or through the press carries evidence of the strides being made by the food industry in putting science to work for the improvement of both the quality and the quantity of the world's food supply. Putting together a group of news items presents a pattern that is important in the advancement of food production and distribution.

In last issue of FOOD TECHNOLOGY, an editorial (written in 1946) named 16 colleges and universities in the United States which offer degree work in food technology. In the same issue, another editorial commented upon the plans of the Agricultural and Mechanical College of Texas to offer a five-year course, beginning with the fall semester, 1947.

Information now has been received that three more of the nation's larger universities offer curricula leading to degrees in food technology. These are Wisconsin, New Jersey, and Maryland. Wisconsin offers both a four- and a five-year curriculum. New Jersey at Rutgers, offers two distinct four-year curricula, one designed to train laboratory food technologists, the other, to train plant food technologists. Maryland offers a four-year course in which it is possible for the student, through his selection of elective courses, to specialize in either the management or the technological phases of the industry.

The rapid expansion of opportunities for college training in food technology is positive evidence that ours is one of the most rapidly developing professions. We have good reason to feel proud of its phenomenal advancement during the few years since its recognition as a profession.

Not only in the universities is food technology advancing scientifically, but in industry and federal organizations as well. Two steps in which the Quartermaster Food and Container Institute for the Armed Forces figures prominently appear destined to help to broaden the appreciation of the importance of food research to the nation and to the rest of the world.

The Quartermaster Institute is collaborating with the Food and Nutrition Board of the National Research Council in conducting a survey of food and nutrition research, in all of its phases, being conducted in the United States and with the Office of Scientific Personnel of the National Research Council in preparing a roster of personnel engaged in food and nutrition research. Perhaps of still greater importance is the formation, announced by Colonel Charles S. Lawrence in August, of an organization, known as the Associates of the Food and Container Institute. This organization is composed of representatives of industrial firms and of scientific foundations in the food field, along with representatives of the Quartermaster Food and Container Institute. Its chief and most valuable function is to disseminate information gained from research as promptly as possible after it is reported.

There is interesting news of increased research activities by well known individual firms of food manufacturers. Two recent announcements are of particular interest.

Editorial

Ralston-Purina Company, St. Louis 2, Missouri has announced the consolidation of all of its research laboratory facilities in a new modern four-story building, containing 35 laboratories engaged in research work in human foods, animal feeds, sanitation products, agricultural chemicals, and farm supplies. Much of the work done in this building will speed the time when our farms will be run by scientists because it is intended to help the farmer to ensure that the products he buys will increase production of meat, milk, and eggs.

The second announcement comes from our neighbor to the north. Canadian Breweries, Ltd., Toronto, is constructing a two-story and basement building to house its newly created Research Institute, which will carry on research work in six principal divisions: (1) equipment development, (2) fermentation, (3) oil, (4) protein, (5) food technology and (6) analytical chemistry.

While agricultural science is not in the realm of food technology, the title of this editorial is significant to food manufacturers and distributors as well as to the producers of the raw products because it gives prophetic expression to the spirit that pervades the food industry.

We in the western hemisphere are wrestling today with the problem of how we shall contribute to the reconstruction of the countries that were devastated and economically demoralized by the war. The theme of the Marshall plan for Europe is to help various nations to rebuild their economic structures. Many Americans feel, with some justification, that Europeans could and should help themselves by working harder than was their wont before the war. We may be inclined to forget that most of those people now are suffering from malnutrition which may prevent their working harder.

The British people are being exhorted by their government to deliver work, work, and more work. At the same time their food rations are reduced drastically. Can they deliver more work on less nourishment? Of even greater importance than working harder is the proper channelling of the work effort. The British, as well as most other Europeans and Asiatics, have, in the past, had a deficiency of interest in technological improvements, as compared to that of North Americans. The reason seems to be that they simply did not believe that many such improvements, which appealed to us, were worth while, or, at least, they believed the improvements were not worth their cost. This attitude of mind may be a normal accompaniment of a love of tradition and of the ways of life of one's ancestors.

Another influence that may retard industrial advancement is a belief that culture can have little in common with science or technology and that studies of science and technology must not be allowed to encroach upon cultural studies. This thought naturally inspires the question of whether or not science and technology are a part of culture. By any correct definition of culture, they are, it seems to me. The reader who doubts this is invited to peruse the dictionary.

While the reason for a nation's lagging interest in technological advancement is worthy of discussion, its only importance rests in the benefit that a discussion may bring in helping to find a way to stir up the nation's interest in technology, because standards of living are determined thereby. Along with all the uncertain aspects of the subject, one thing is certain, which is that people with real interest in life desire a high standard of living. I believe this thoroughly, notwithstanding my recollection of a remark that was

made to me in 1945, just after the close of hostilities in Europe, by an intelligent English citizen, who believed, or at least argued to the effect, that our wars were caused by our insistence upon enjoying the conveniences of living that technology has produced. The remark was, "I should rather have peace than plumbing."

The order of world economy has so changed that no longer can "muddling through" bring a happy outcome. Long-range planning is necessary and no planning today is long range without the inclusion of a generous amount of scientific and technological research.

The first thing that destitute peoples need is nourishing food. Through our applications of agricultural science and food technology, we must do what we can to tide them over with food until their thoughts can begin to extend beyond their day-to-day troubles and, with restimulated interest, they will use their increased energy in harder work, harder work not only to produce needed commodities but harder work also to plan beyond tomorrow and to prepare for the future through research.

Following up our material aid with technological assistance should be just as important in the food line as in other industrial lines and just as important for other countries as it is for Greece, where this plan is already in effect in certain fields of industrial activity. Material help alone will not be lasting. Unless at least a moderate desire to advance technologically and a will to work hard to bring about this advancement can be instilled into the minds of the needy people, it would be well at the outset to admit the hopelessness of the task of reconstruction, say "We're sorry," and wait for the end of civilization.

We are not primarily concerned at this moment with the question of whether or not the British used their loan wisely. In the future, through necessity, they will procure as much food as their resources can command. If their use of the loan has not been intelligent, we might ask whether or not our legislators could also have shown greater intelligence by applying the restrictions on the loan to how it would be spent rather than to where it would be spent.

The report of the President's Scientific Research Board, published August 28 stated, "The security and prosperity of the United States depend today, as never before, upon the rapid expansion of scientific knowledge." It also stated that the boundaries of scientific knowledge must be pushed back to ensure full production and full employment. These statements apply not only to the United States; they apply even more to the rest of the world.

Louis Bromfield said, "A specialized farm of 100 acres operated under an efficient plan produces five to ten times as much income with much less labor than the same acreage operated under the old system of 'egg money' for the wife." We are happy to be able to point to new indications that the food manufacturing industry is impatient for the demise of the "egg money" system of operation as far as food manufacturing plants are concerned.

C. O. Ball.

LIQUID SUGAR IN FOOD PRODUCTS[a]

W. R. JUNK, O. M. NELSON AND M. H. SHERRILL
California and Hawaiian Sugar Refining Corporation, Ltd.
San Francisco 5, Calif.

The more common physical properties of solutions of sucrose, and of mixtures of sucrose and invert sugar are presented together with graphs and tabulations.

Cane sugar, technically known as sucrose, is one of the most widely distributed of Mother Nature's sweeteners. It occurs naturally and plentifully in sugar cane, sorghum cane, the sugar beet, the sap of the maple tree and of the Nipa palm. It is present to a lesser extent in a multitude of other plants.

Under appropriate conditions sucrose is converted by acids—and also by the enzyme, invertase—into a mixture of the two simpler sugars, levulose and dextrose. This mixture is commonly called "invert sugar," and has almost the same sweetness as its parent sugar. However, in some of its other properties invert sugar differs

CALIFORNIA AND HAWAIIAN SUGAR REFINING CORPORATION, LIMITED

TEMPERATURE CORRECTIONS FOR BRIX HYDROMETERS
(Calibrated at 20°C)
Based on Table 110 of Bureau of Standards Circular C-440

Temperature		Observed Per Cent of Sugar														
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
Cent.	F.	Correction to Be Subtracted from Observed Per Cent														
0	32.0	0.30	0.49	0.65	0.77	0.89	0.99	1.08	1.16	1.24	1.31	1.37	1.41	1.44	1.47	1.49
5	41.0	0.36	0.47	0.56	0.65	0.73	0.80	0.86	0.91	0.97	1.01	1.05	1.08	1.10	1.12	1.14
10	50.0	0.32	0.38	0.43	0.48	0.52	0.57	0.60	0.64	0.67	0.70	0.72	0.74	0.75	0.76	0.77
11	51.8	0.31	0.35	0.40	0.44	0.48	0.51	0.55	0.58	0.60	0.63	0.65	0.66	0.68	0.69	0.70
12	53.6	0.29	0.32	0.36	0.40	0.43	0.46	0.50	0.52	0.54	0.56	0.58	0.59	0.60	0.61	0.62
13	55.4	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.46	0.48	0.49	0.51	0.52	0.53	0.54	0.55
14	57.2	0.24	0.26	0.29	0.31	0.34	0.36	0.38	0.40	0.41	0.42	0.44	0.45	0.46	0.47	0.47
15	59.0	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.33	0.34	0.36	0.36	0.37	0.38	0.38	0.39
16	60.8	0.17	0.18	0.20	0.22	0.23	0.25	0.26	0.27	0.28	0.28	0.29	0.30	0.31	0.32	0.32
17	62.6	0.13	0.14	0.15	0.16	0.18	0.19	0.20	0.20	0.21	0.21	0.22	0.23	0.23	0.23	0.24
18	64.4	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.16	0.16
19	66.2	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08
20	68.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Correction to be Added to Observed Per Cent														
21	69.8	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.09
22	71.6	0.10	0.10	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.16	0.16	0.16
23	73.4	0.16	0.16	0.17	0.17	0.19	0.20	0.21	0.21	0.22	0.23	0.24	0.24	0.24	0.24	0.24
24	75.2	0.21	0.22	0.23	0.24	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.32	0.32
25	77.0	0.27	0.28	0.30	0.31	0.32	0.34	0.35	0.36	0.38	0.38	0.39	0.39	0.40	0.39	0.39
26	78.8	0.33	0.34	0.36	0.37	0.40	0.40	0.42	0.44	0.46	0.47	0.47	0.48	0.48	0.48	0.48
27	80.6	0.40	0.41	0.42	0.44	0.46	0.48	0.50	0.52	0.54	0.54	0.55	0.56	0.56	0.56	0.56
28	82.4	0.46	0.47	0.49	0.51	0.54	0.56	0.58	0.60	0.61	0.62	0.63	0.64	0.64	0.64	0.64
29	84.2	0.54	0.55	0.56	0.59	0.61	0.63	0.66	0.68	0.70	0.70	0.71	0.72	0.72	0.72	0.72
30	86.0	0.61	0.62	0.63	0.66	0.68	0.71	0.73	0.76	0.76	0.78	0.79	0.80	0.80	0.80	0.81
35	95.0	0.99	1.01	1.02	1.06	1.10	1.13	1.16	1.18	1.20	1.21	1.22	1.22	1.23	1.22	1.22
40	104.0	1.42	1.45	1.47	1.51	1.54	1.57	1.60	1.62	1.64	1.65	1.65	1.65	1.66	1.65	1.65
45	113.0	1.91	1.94	1.98	2.00	2.03	2.05	2.07	2.09	2.10	2.10	2.10	2.10	2.10	2.09	2.08
50	122.0	2.46	2.48	2.50	2.53	2.56	2.57	2.58	2.59	2.59	2.58	2.58	2.57	2.56	2.54	2.52
55	131.0	3.05	3.07	3.09	3.12	3.12	3.12	3.12	3.11	3.10	3.08	3.07	3.05	3.03	3.00	2.97
60	140.0	3.69	3.72	3.73	3.73	3.72	3.70	3.67	3.65	3.62	3.60	3.57	3.54	3.50	3.47	3.43
65	149.0	4.4	4.4	4.4	4.4	4.4	4.4	4.3	4.2	4.2	4.1	4.1	4.0	4.0	--	3.9
70	158.0	5.1	5.1	5.1	5.0	5.0	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	--	4.4
75	167.0	6.1	6.0	6.0	5.9	5.8	5.8	5.7	5.6	5.5	5.4	5.4	5.3	5.2	--	5.0
80	176.0	7.1	7.0	7.0	6.9	6.8	6.7	6.6	6.4	6.3	6.2	6.1	6.0	5.9	--	5.6

EXAMPLE: If hydrometer reads 50° Bx. at 60° C the Corrected reading would be 50 + 3.57 or 53.57° Bx.

FIG. 1.

[a] Presented before the Sixth Annual Food Conference, Buffalo, N. Y., March 18, 1946.

materially from the original sucrose from which it is derived. Invert sugar accompanies sucrose, in widely varying proportions, in a great many natural foods, particularly fruits.

Since sucrose—and its derivative, invert sugar—are widely present in food products, the food technologist is naturally interested in, and concerned with, the different properties of these natural sweeteners.

Many properties of sucrose are tabulated in the literature, but those of invert sugar—and particularly of mixtures of it with sucrose—are less well known. As the available information on these properties seems to be rather scattered, it is the purpose of this paper to bring together some of the more useful published data, together with some original, unpublished material of our own. Particular emphasis is laid upon solutions of sucrose, of invert sugar, and of mixtures of these natural sweeteners.

CALIFORNIA AND HAWAIIAN SUGAR REFINING CORPORATION, LIMITED

TEMPERATURE CORRECTIONS FOR REFRACTOMETERS

(When the readings are made at temperatures other than 20° C)

Temperature	Percentage of Sucrose														
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
	Subtract from the percentage of sucrose														
°C															
10	0.50	0.54	0.58	0.61	0.64	0.66	0.68	0.70	0.72	0.73	0.74	0.75	0.76	0.78	0.79
11	.46	.49	.53	.55	.58	.60	.62	.64	.65	.66	.67	.68	.69	.70	.71
12	.42	.45	.48	.50	.52	.54	.56	.57	.58	.59	.60	.61	.61	.63	.63
13	.37	.40	.42	.44	.46	.48	.49	.50	.51	.52	.53	.54	.54	.55	.55
14	.33	.35	.37	.39	.40	.41	.42	.43	.44	.45	.45	.46	.46	.47	.48
15	.27	.29	.31	.33	.34	.34	.35	.36	.37	.37	.38	.39	.39	.40	.40
16	.22	.24	.25	.26	.27	.28	.28	.29	.30	.30	.30	.31	.31	.32	.32
17	.17	.18	.19	.20	.21	.21	.21	.22	.22	.23	.23	.23	.23	.24	.24
18	.12	.13	.13	.14	.14	.14	.14	.15	.15	.15	.15	.16	.16	.16	.16
19	.06	.06	.06	.07	.07	.07	.07	.08	.08	.08	.08	.08	.08	.08	.08
	Add to the percentage of sucrose														
21	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
22	.13	.13	.14	.14	.15	.15	.15	.15	.15	.16	.16	.16	.16	.16	.16
23	.19	.20	.21	.22	.22	.23	.23	.23	.23	.24	.24	.24	.24	.24	.24
24	.26	.27	.28	.29	.30	.30	.31	.31	.31	.31	.31	.32	.32	.32	.32
25	.33	.35	.36	.37	.38	.38	.39	.40	.40	.40	.40	.40	.40	.40	.40
26	.40	.42	.43	.44	.45	.46	.47	.48	.48	.48	.48	.48	.48	.48	.48
27	.48	.50	.52	.53	.54	.55	.55	.56	.56	.56	.56	.56	.56	.56	.56
28	.56	.57	.60	.61	.62	.63	.63	.64	.64	.64	.64	.64	.64	.64	.64
29	.64	.66	.68	.69	.71	.72	.72	.73	.73	.73	.73	.73	.73	.73	.73
30	.72	.74	.77	.78	.79	.80	.80	.81	.81	.81	.81	.81	.81	.81	.81

International Temperature Correction Table, 1936, adopted by the International Commission for Uniform Methods of Sugar Analysis (Int. Sugar J. 39, 24s, 1937).

FIG. 2.

The entire subject of the use of sugar solutions in food industries cannot possibly be covered in the present brief paper. However, the data presented are considered to be those which the average food technologist would use most often when dealing with sugar solutions in the manufacturing of food products, and as reference information to permit prediction as to possible behavior of sugar solutions. The term "possible behavior" is used advisedly since the presence of non-sugars (such as salts, etc.) in solutions exerts both a qualitative and quantitative effect upon the properties of sugar solutions.

MEASUREMENT OF CONCENTRATION

Measurement of concentration, the most basic of sugar analyses, is frequently a source of error in evaluating sugar solutions. Temperature corrections for instruments used in measuring concentration are frequently misapplied or not applied at all. Figs. 1 and 2 show the temperature corrections which should be applied to hydrometers and refractometers which are calibrated at 20° C. The examples with these tables indicate the correct use of these data. It should be mentioned that occasionally instruments are calibrated at temperatures other than 20° C. and in those instances these data do not strictly apply.

The data in Figs. 1 and 2 are based on pure sucrose solutions. Mixtures of sucrose and simple sugars or pure solutions of simple sugars have sufficiently different refractive indices to introduce errors in analyses. The order of these differences may be seen in Fig. 3, which shows the refractive indices of the more common commercial sugars.

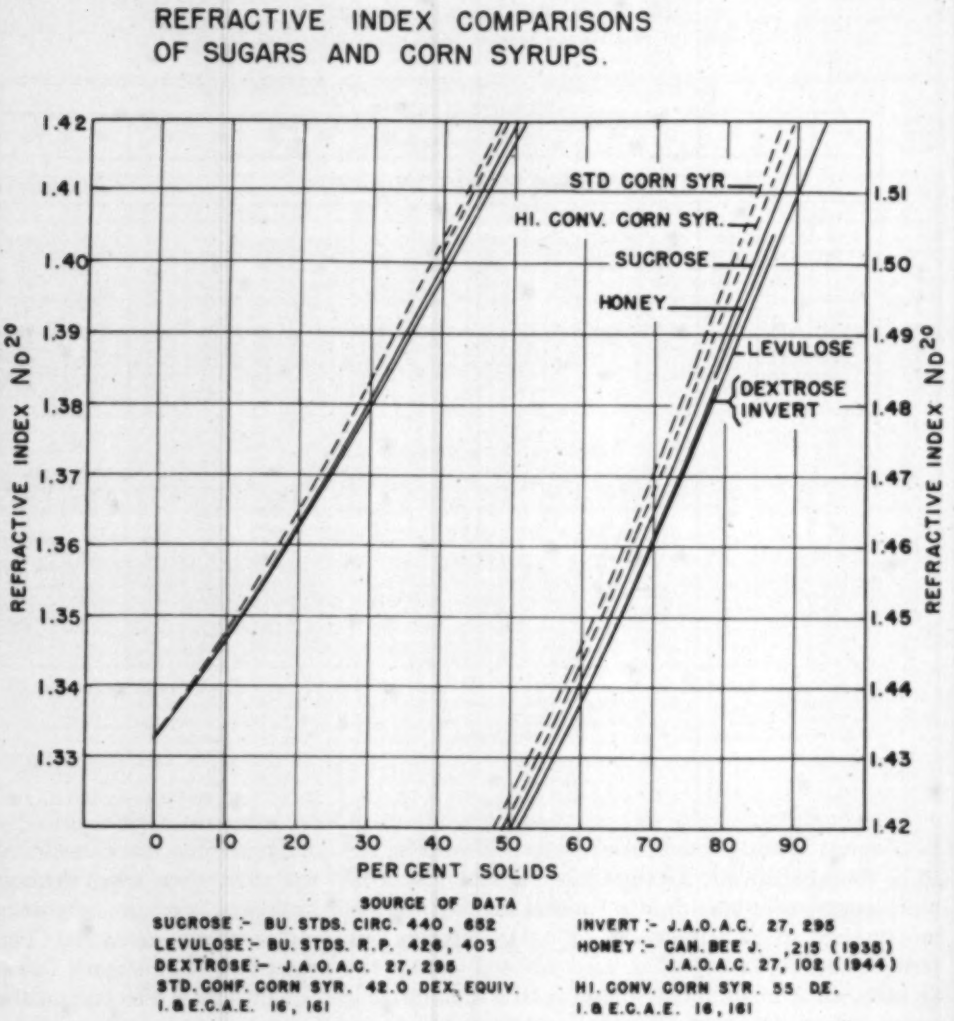

FIG. 3.

WEIGHTS OF SUGAR SOLUTIONS

The weights of sugar solutions and examples of simple sugar calculations are given in Fig. 4. Certain pertinent data which should assist the technologist to predict the behavior of such mixtures are presented. Although these data are based on pure sucrose solutions, experience has shown them to be sufficiently close for most plant operating purposes.

CALIFORNIA AND HAWAIIAN SUGAR REFINING CORPORATION, LIMITED

WEIGHTS OF SUGAR SOLUTIONS
At 20°C (68°F)
Based on Table 117, Bureau of Standards Circular C-440

Brix	Weight per Gallon (lbs.)	Weight of Sugar (lbs)	Weight of Water (lbs)	Brix	Weight per Gallon (lbs)	Weight of Sugar (lbs)	Weight of Water (lbs)	Brix	Weight per Gallon (lbs)	Weight of Sugar (lbs)	Weight of Water (lbs)
0	8.32	0	8.32								
5	8.49	.42	8.07								
6	8.52	.51	8.01	36	9.64	3.47	6.17	66	11.03	7.28	3.75
7	8.55	.60	7.95	37	9.68	3.58	6.10	67	11.08	7.42	3.66
8	8.59	.69	7.90	38	9.72	3.70	6.02	68	11.13	7.57	3.56
9	8.62	.78	7.84	39	9.77	3.81	5.96	69	11.18	7.72	3.46
10	8.66	.87	7.79	40	9.81	3.92	5.89	70	11.23	7.86	3.37
11	8.69	.96	7.73	41	9.85	4.04	5.81	71	11.29	8.01	3.28
12	8.72	1.05	7.67	42	9.90	4.16	5.74	72	11.34	8.16	3.18
13	8.76	1.14	7.62	43	9.94	4.27	5.67	73	11.39	8.32	3.07
14	8.80	1.23	7.57	44	9.98	4.39	5.59	74	11.45	8.47	2.98
15	8.83	1.32	7.51	45	10.03	4.51	5.52	75	11.50	8.62	2.88
16	8.87	1.42	7.45	46	10.07	4.63	5.44	76	11.55	8.78	2.77
17	8.90	1.51	7.39	47	10.12	4.75	5.37	77	11.61	8.94	2.67
18	8.94	1.61	7.33	48	10.16	4.88	5.28	78	11.66	9.10	2.56
19	8.98	1.71	7.27	49	10.21	5.00	5.21	79	11.72	9.26	2.46
20	9.01	1.80	7.21	50	10.26	5.13	5.13	80	11.77	9.42	2.35
21	9.05	1.90	7.15	51	10.30	5.25	5.05	81	11.83	9.58	2.25
22	9.09	2.00	7.09	52	10.35	5.38	4.97	82	11.88	9.74	2.14
23	9.13	2.10	7.03	53	10.39	5.51	4.88	83	11.94	9.91	2.03
24	9.16	2.20	6.96	54	10.44	5.64	4.80	84	12.00	10.08	1.92
25	9.20	2.30	6.90	55	10.49	5.77	4.72	85	12.05	10.25	1.80
26	9.24	2.40	6.84	56	10.53	5.90	4.63	86	12.11	10.42	1.69
27	9.28	2.51	6.77	57	10.58	6.03	4.55	87	12.17	10.59	1.58
28	9.32	2.61	6.71	58	10.63	6.17	4.46	88	12.23	10.76	1.47
29	9.36	2.71	6.65	59	10.68	6.30	4.38	89	12.28	10.93	1.35
30	9.40	2.82	6.58	60	10.73	6.44	4.29	90	12.34	11.11	1.23
31	9.44	2.93	6.51	61	10.78	6.57	4.21	91	12.40	11.28	1.12
32	9.48	3.03	6.45	62	10.83	6.71	4.12	92	12.46	11.46	1.00
33	9.52	3.14	6.38	63	10.88	6.85	4.03	93	12.52	11.64	0.88
34	9.56	3.25	6.31	64	10.93	6.99	3.94	94	12.58	11.82	0.76
35	9.60	3.36	6.24	65	10.98	7.14	3.84	95	12.64	12.01	0.63

EXAMPLE:

It is desired to make 100 gallons of 50° Brix syrup.
From the above it is seen that each gallon of 50° syrup contains 5.13 lbs. sugar and 5.13 lbs. water. Therefore to make 100 gallons would require 5.13 x 100 or 513 lbs. sugar and 5.13 x 100 or 513 lbs. water. From above we see that each gallon of water (0° Bx) weighs 8.32 lbs. So to determine the number of gallons of water required, divide 513 by 8.32 or about 61.7 gallons.

FIG. 4.

INVERT SUGAR DATA

Mixtures of sucrose and simple sugars are very common in food products, either because sucrose-invert mixtures are used as basic raw materials or because, due to the presence of heat or acid or both, sucrose may be inverted to simple sugars.

Effect of Acid Concentration on the Inversion of Liquid Sugar

Figs. 5 and 6 show the effect of acid concentration on the inversion rate of a pure sugar solution using hydrochloric and tartaric acid, respectively. In both instances the percentage of acid is expressed as dry acid on sugar solids.

The rate of inversion of liquid sugar achieved by the use of .005 percent hydrochloric acid or .05 percent tartaric acid has been found to be adequate for most commercial uses. For large scale production of partly inverted liquid sugars whose invert content should be within narrow limits, it is desirable to blend a 90 to 95

TYPICAL CURVES SHOWING EFFECT OF ACID CONCENTRATION ON INVERSION OF LIQUID SUGAR BY HYDROCHLORIC ACID. TEMP. 90° C.

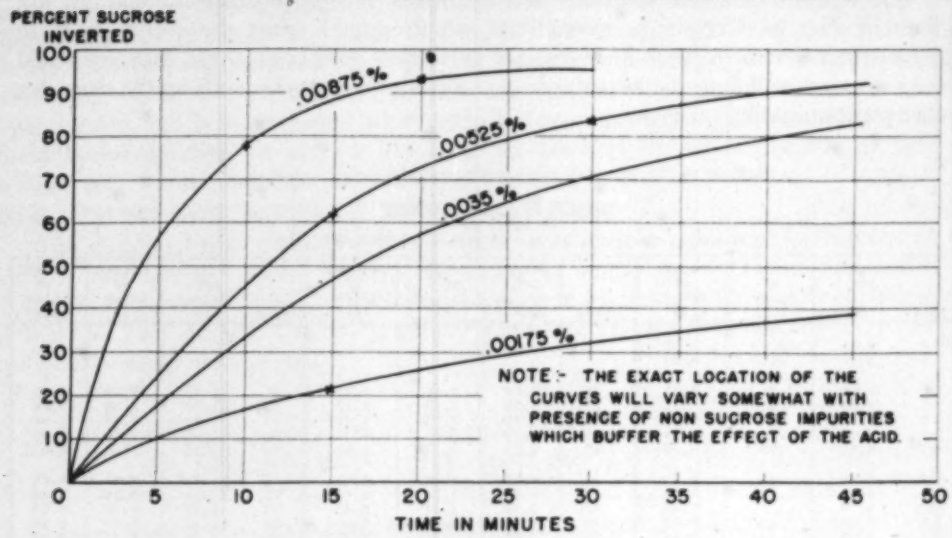

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FIG. 5.

TYPICAL CURVES SHOWING EFFECT OF ACID CONCENTRATION ON INVERSION OF A LIQUID SUGAR BY TARTARIC ACID. TEMP. 100° C.

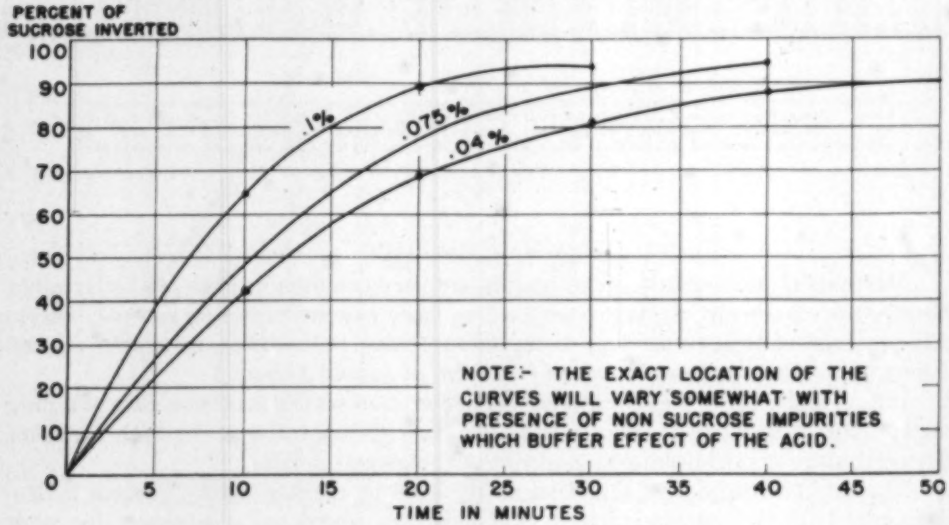

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FIG. 6.

percent inverted product with a syrup of like density which has not been inverted. This suggestion is based on the fact that it is difficult, if not impossible, to stop inversion at a specified intermediate point.

The Effect of Temperature on the Inversion of Liquid Sugar

As in the case of acid concentration, temperature also plays an important part in regulating the rate of inversion of sucrose solutions. Fig. 7 indicates a typical rate of inversion for a pure liquid sugar at three representative temperatures. For reasons that will be explained later it is desirable to invert sucrose solutions at the lowest temperature that is consistent with the time cycle for the equipment used.

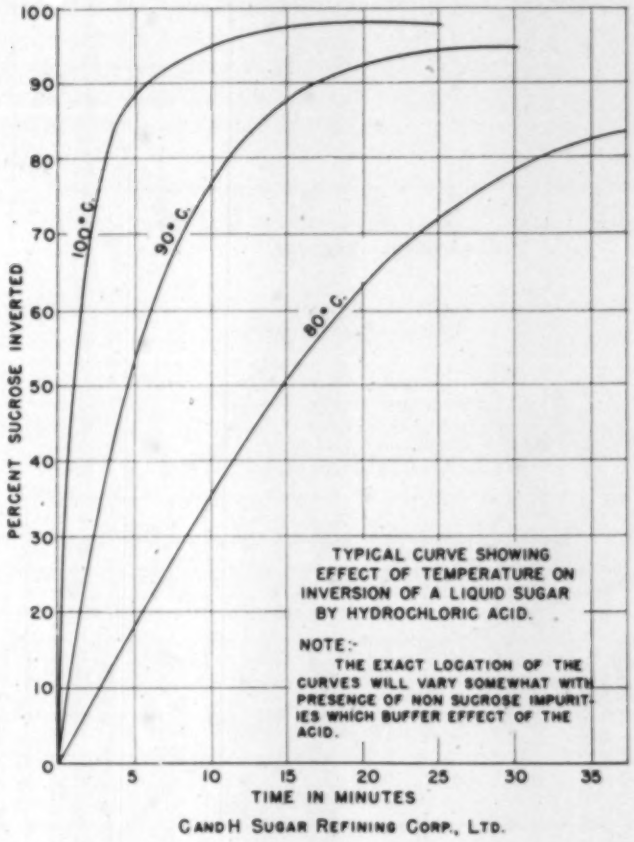


FIG. 7.

Effect of Temperature on the Rate of Color Development in Invert Sugar Liquors

As mentioned above, the lowest practical temperature for the inversion of sugar solutions should be used. Fig. 8 shows a typical curve for the development of color in invert sugar syrups containing high percentages of invert sugars. This rate of color development should, obviously, be given considerable attention, particularly for quality products in which excessive color is undesirable.

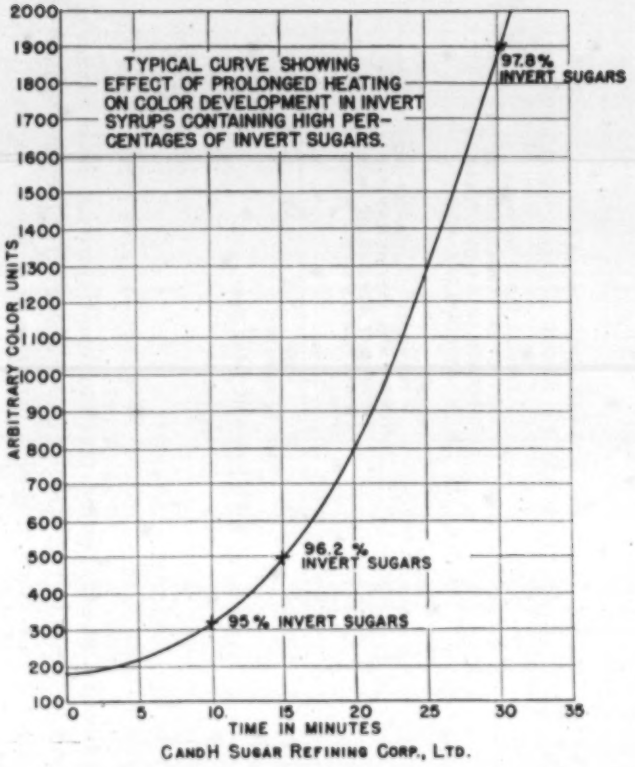

TYPICAL CURVE SHOWING
EFFECT OF PROLONGED HEATING
ON COLOR DEVELOPMENT IN INVERT
SYRUPS CONTAINING HIGH PER-
CENTAGES OF INVERT SUGARS.
97.8%
INVERT SUGARS
96.2 %
INVERT SUGARS
95 % INVERT SUGARS
ARBITRARY COLOR UNITS
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
5
10
15
20
25
30
35
TIME IN MINUTES
CANDH SUGAR REFINING CORP., LTD.

FIG. 8.

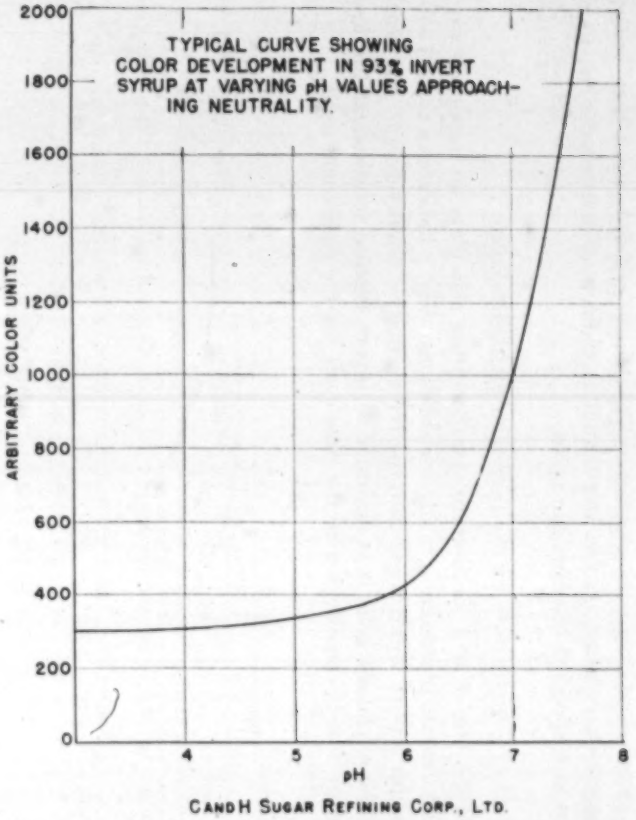

TYPICAL CURVE SHOWING
COLOR DEVELOPMENT IN 93% INVERT
SYRUP AT VARYING pH VALUES APPROACH-
ING NEUTRALITY.
ARBITRARY COLOR UNITS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
4
5
6
7
8
pH
CANDH SUGAR REFINING CORP., LTD.

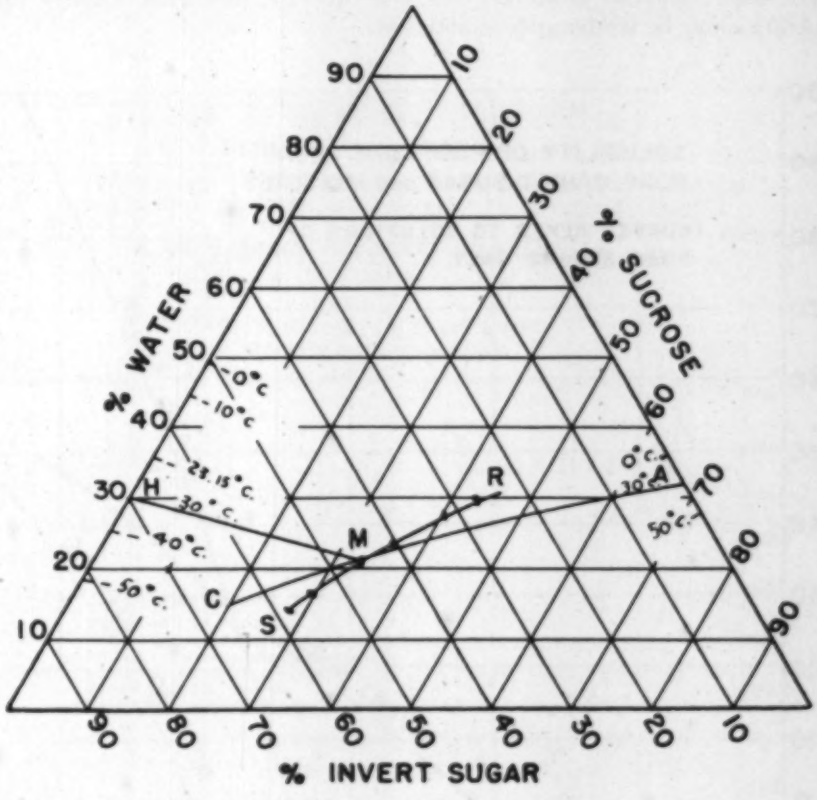
FIG. 9.

Rate of Color Development in Invert Syrups at Varying pH Values

The pH of invert sugar solutions also has a profound influence on the rate of color development. Fig. 9 illustrates a typical curve showing the color development in a 93 percent invert syrup at varying pH values approaching neutrality. If a minimum of color in a finished syrup is essential, this curve indicates the desirability of postponing neutralization of the acid to the last possible moment before cooling is completed.

Sucrose-Invert Sugar Solubility

Fig. 10 indicates the sucrose-invert sugar-water solubility system. By use of this graph it is possible to predict with some degree of certainty the possible behavior of water, sucrose, invert mixtures. Point A is the true solubility at 30° C. (68.7 percent). Point H is the composition of a pure invert sugar solution saturated with respect to its own dextrose at 30° C. (69.7 percent). Line AC represents the solubility of cane sugar in the presence of varying amounts of invert sugars at 30° C., and line RS is the loci of mixtures of sucrose and invert sugar saturated with respect to both sucrose and dextrose. Point M upon this line is the composition of the most



THE SYSTEM - SUCROSE - INVERT SUGAR AND WATER.
(ADAPTED FROM BU. STDS. TECH. PAPER 259)

FIG. 10.

soluble mixtures at 30° C. (33.6 percent sucrose, 45.5 percent invert, 21 percent water). The most soluble mixtures of sucrose and invert sugar are given below for several temperatures.

MOST SOLUBLE MIXTURES OF SUGAR AND INVERT
(From Table 144 Bur. Stds. Circular C 440)

Temperature	Cane sugar	Invert sugar	Total sugars	Water
° C.,	percent	percent	percent	percent
0	43.7	27.2	70.9	29.1
10	40.9	31.8	72.7	27.3
15	39.1	34.8	73.9	26.1
23.15	36.3	39.9	76.2	23.8
30	33.6	45.4	79.0	21.0
40	31.1	50.7	81.8	18.2
50	27.7	58.0	85.7	14.3

The above data are graphically presented in one of the curves of Fig. 11.

It should be pointed out that these data are based on true final solubilities. The effects of viscosity and possibly other factors frequently retard the crystallization of invert sugar, sucrose mixtures, and consequently somewhat higher "apparent" solubilities may be temporarily maintained.

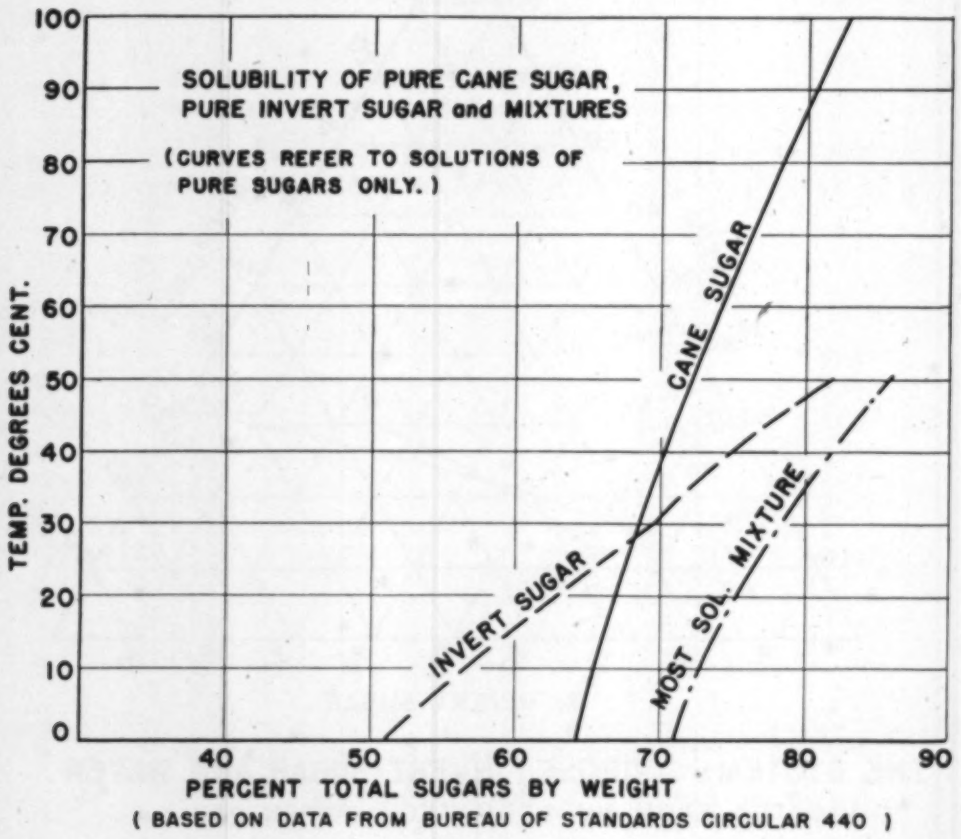


FIG. 11.

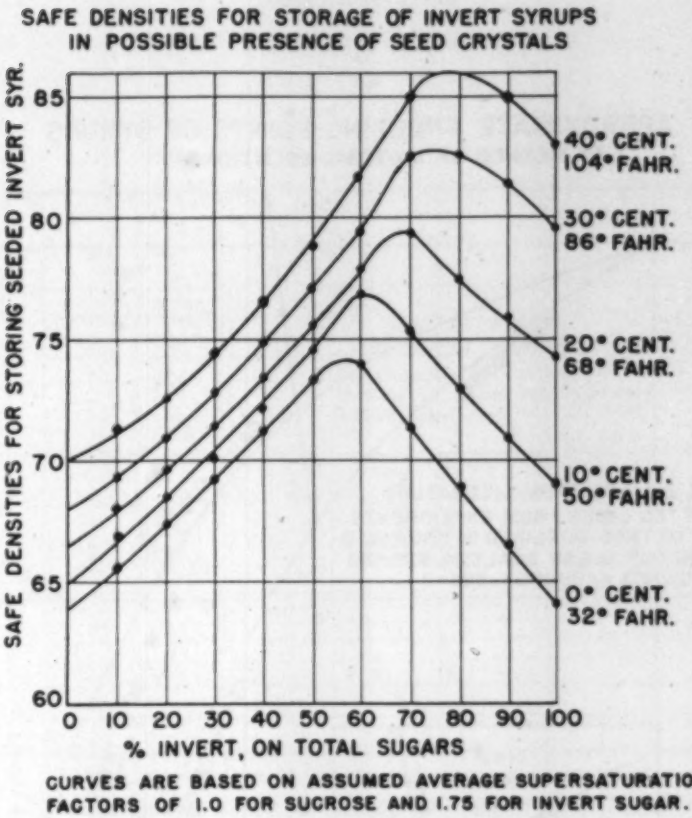

SAFE DENSITIES FOR STORAGE OF INVERT SYRUPS
IN POSSIBLE PRESENCE OF SEED CRYSTALS
SAFE DENSITIES FOR STORING SEEDED INVERT SYR.
85
80
75
70
65
60
40° CENT.
104° FAHR.
30° CENT.
86° FAHR.
20° CENT.
68° FAHR.
10° CENT.
50° FAHR.
0° CENT.
32° FAHR.
0 10 20 30 40 50 60 70 80 90 100
% INVERT, ON TOTAL SUGARS
CURVES ARE BASED ON ASSUMED AVERAGE SUPERSATURATION
FACTORS OF 1.0 FOR SUCROSE AND 1.75 FOR INVERT SUGAR.
C AND H SUGAR REFINING CORP., LTD.

FIG. 12.

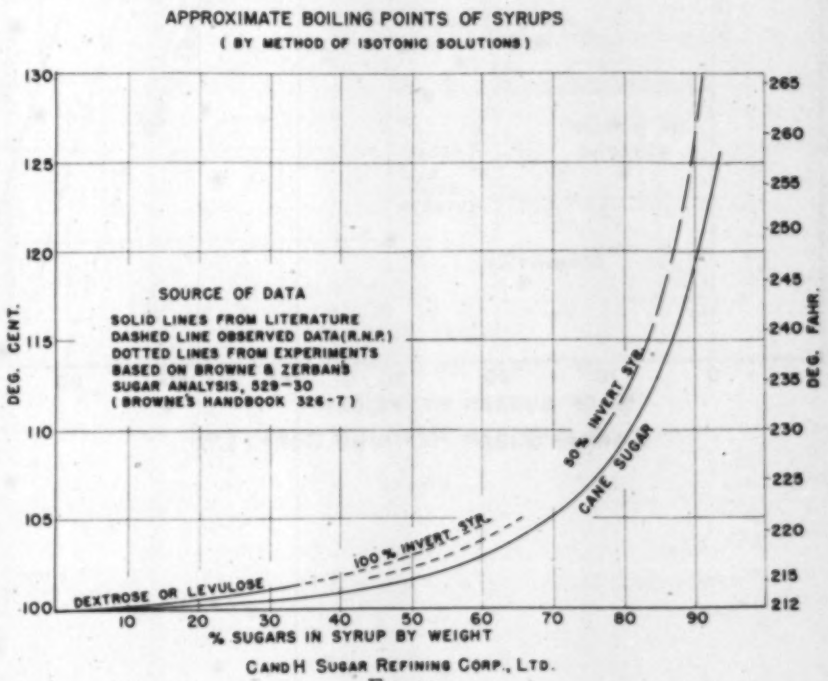

APPROXIMATE BOILING POINTS OF SYRUPS
(BY METHOD OF ISOTONIC SOLUTIONS)
DEG. CENT.
130
125
120
115
110
105
100
DEG. FAHR.
265
260
255
250
245
240
235
230
225
220
215
212
SOURCE OF DATA
SOLID LINES FROM LITERATURE
DASHED LINE OBSERVED DATA(R.N.P.)
DOTTED LINES FROM EXPERIMENTS
BASED ON BROWNE & ZERBAN
SUGAR ANALYSIS, 529-30
(BROWNE'S HANDBOOK 326-7)
50% INVERT SYR.
CANE SUGAR
100% INVERT SYR.
DEXTROSE OR LEVULOSE
10 20 30 40 50 60 70 80 90
% SUGARS IN SYRUP BY WEIGHT
C AND H SUGAR REFINING CORP., LTD.

FIG. 13.

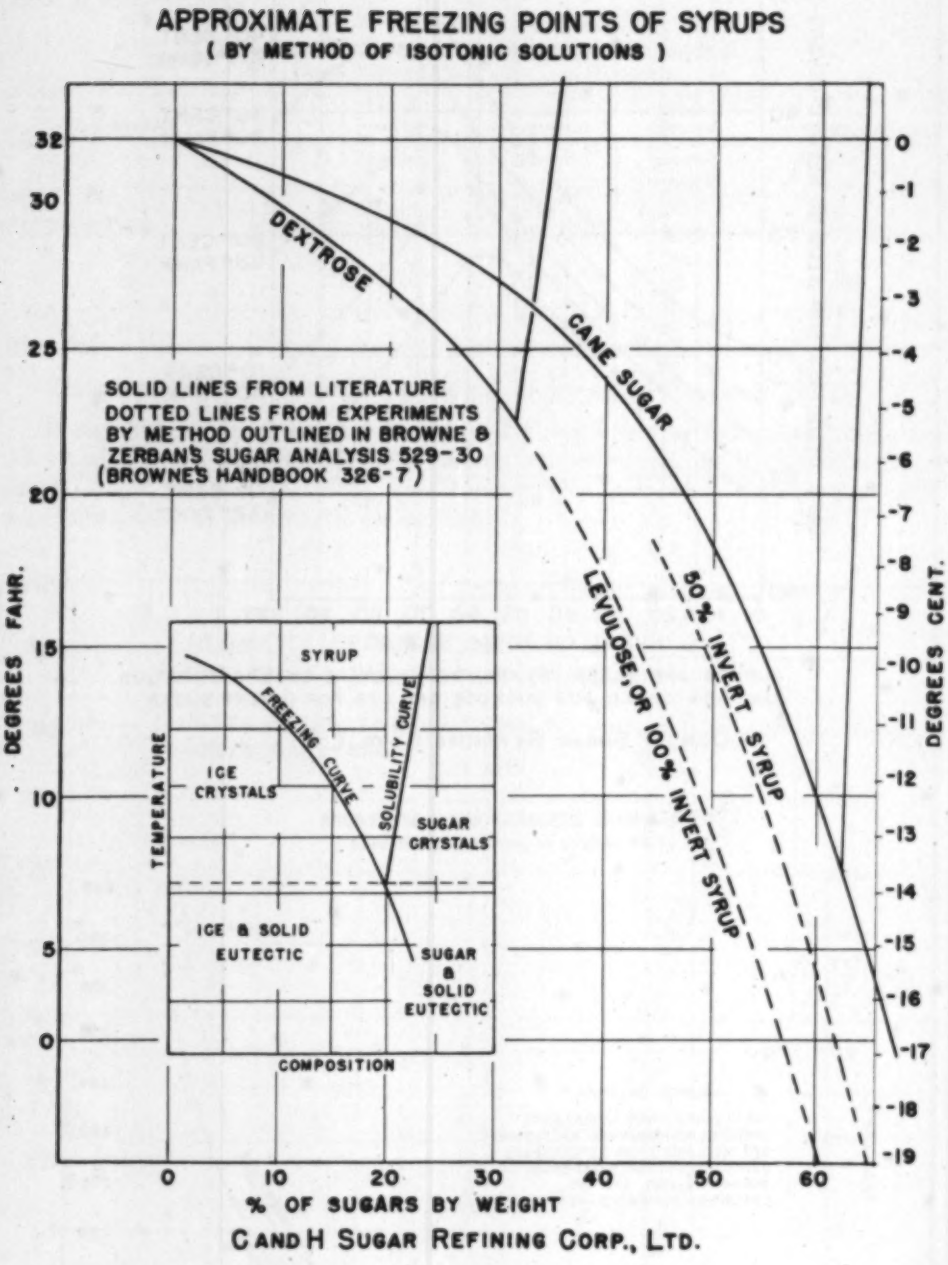

APPROXIMATE FREEZING POINTS OF SYRUPS
(BY METHOD OF ISOTONIC SOLUTIONS)
DEXTROSE
CANE SUGAR
LEVULOSE, OR 100% INVERT SYRUP
50% INVERT SYRUP
SOLID LINES FROM LITERATURE
DOTTED LINES FROM EXPERIMENTS
BY METHOD OUTLINED IN BROWNE & ZERBAN'S SUGAR ANALYSIS 529-30
(BROWNE'S HANDBOOK 326-7)
SYRUP
FREEZING CURVE
SOLUBILITY CURVE
ICE CRYSTALS
SUGAR CRYSTALS
ICE & SOLID EUTECTIC
SUGAR & SOLID EUTECTIC
TEMPERATURE
COMPOSITION
DEGREES FAHR.
DEGREES CENT.
% OF SUGARS BY WEIGHT
C AND H SUGAR REFINING CORP., LTD.

FIG. 14.

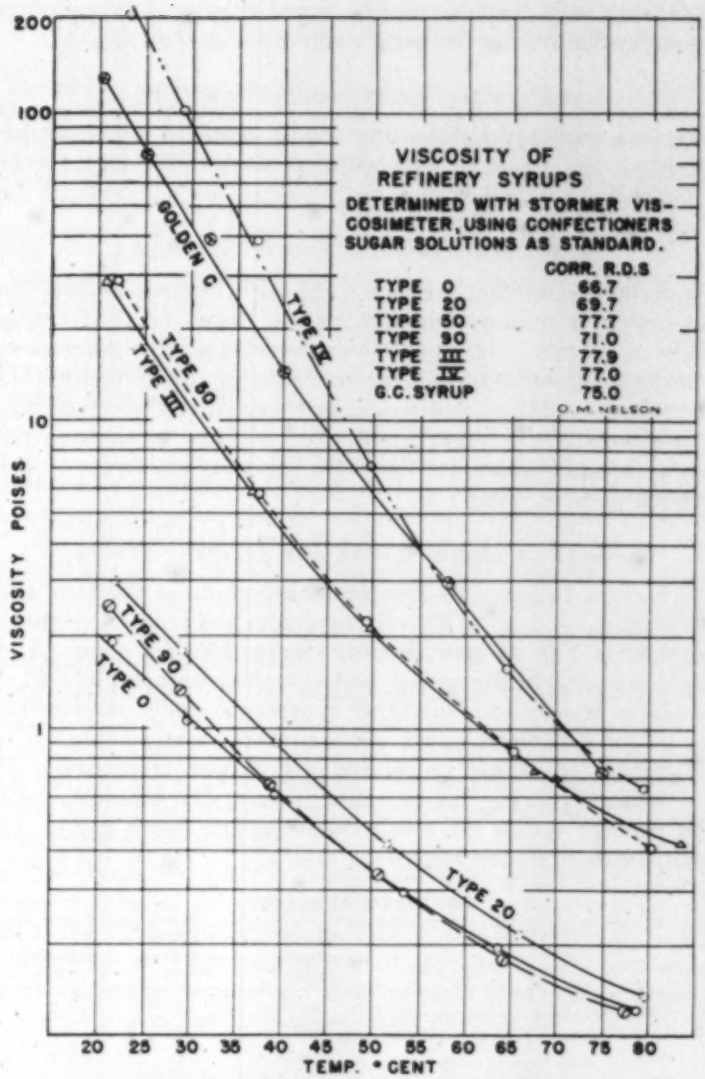


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FIG. 15.

Storage of Sucrose-Invert Sugar Solutions

The presence of seed crystals (either sucrose or dextrose) may alter the rate at which crystallization might be expected in stored sugar solutions. Fig. 12 has been prepared to show the densities and composition at which pure sucrose-invert sugar mixtures (containing seed crystals) may be stored at various temperatures without danger of crystallization during the usual commercial storage periods.

APPROXIMATE BOILING POINTS OF SYRUPS

Frequently, it is necessary to know the boiling points of sugar solutions having known composition. Fig. 13 shows such boiling points for pure sugars and mixtures. It should be noted that the broken lines on this figure are approximate only.

APPROXIMATE FREEZING POINTS OF SYRUPS

For those technologists who are concerned with freezing or low temperature operations, the effect of various concentrations of sugars on the freezing point of solutions will be of interest. Fig. 14 shows the freezing point of sucrose, invert, and mixtures at various concentrations. The small drawing within the graph illustrates the phase of the sugar mixture that would be expected at corresponding points in the various quadrants of the larger graph. (In addition to showing the freezing points of these syrups, this chart also shows the solubility of sucrose at temperatures below the freezing point of water.)

VISCOSITY OF LIQUID SUGARS AND REFINERY SYRUPS

Viscosity of sugar mixtures is frequently important to the food technologist. While it is difficult to cover all of the various grades and types of commercial syrup available, the data in Fig. 15 give viscosity comparisons for some typical syrups. The following description of the syrups used as typical examples in Fig. 15 is given in order to assist in comparison with other syrups sold under various trade names. Types 0, 20, 50 and 90 refer to pure sucrose-invert sugar solutions in which the total solids contain 0, 20, 50 and 90 percent invert sugar, respectively. Percentage total solids is indicated in Fig. 15 by refractometric dry substance (abbreviated: R.D.S.). The refinery syrups for which viscosities are shown in Fig. 15 have the following approximate dry basis analysis:

DRY BASIS ANALYSIS

	Type III refinery syrup	Type IV refinery syrup	Golden C syrup
Sucrose	30	52	65
Invert	62	34	17
Ash	4	8	11
Other non-sugars	4	6	7

SUMMARY

The foregoing discussion has described some of the more common physical properties of solutions of sucrose and of mixtures of sucrose and invert sugar. These explanations, together with the related graphs and tabulations, should be of interest to any food technologist concerned with use of sugars and syrups.

REMOVAL OF SUGAR FROM RAW EGG WHITE BY YEAST BEFORE DRYING [a, b]

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Methods of removing glucose from egg white by natural fermentation and by the use of selected bacterial organisms are discussed. Yeast (Saccharomyces cerevisiae) is able to remove glucose from egg white provided yeast extract is added as a growth stimulant. When large masses of yeast cells are used, the need for yeast extract is obviated. Presumably, sufficient growth factors remain available or are supplied to promote fermentative activity. Yeast is more suitable than bacteria and the fermentation can be more readily controlled than can that of bacteria.

Initial pH of egg white has marked effect on the speed of glucose removal. By suitable selection of appropriate surface areas the pH at the glucose free stage of fermentation may be kept above pH 6.4. This permits fermentation without altering the physical properties of the mucin.

The results of large scale experiments indicate that this fermentation method has commercial possibilities.

INTRODUCTION

Commercial fermentation of raw egg white prior to drying has been adopted as a step necessary for the production of a stable, dried egg albumen. A large number of workers have shown that natural, dried egg white deteriorates upon storage while fermented albumen retains the properties it had at the time of drying. Stewart and Kline *(22)* associated instability changes in unfermented egg white with the presence of glucose. They indicated, further, that this sugar must be removed if a stable, dry albumen is to be produced.

Although it is common practice among egg processors to permit a spontaneous fermentation to take place, very few controlled fermentations exist. The commercial fermentations depend, rather, upon the normal flora introduced with the egg or upon that already residing in the fermenting tank. Since containers in which egg white is allowed to ferment are usually constructed of wood, bacterial impregnation is almost an assumed certainty.

During the incubation period, usually three to seven days, microorganisms develop at the expense of the carbohydrate and, owing to conversion of glucose to acid, mucin in the thick white contracts, collects as a stringy layer, and is removed. When the bulk of glucose has been converted, the fermented white becomes watery and is considered ready for drying. If allowed to continue fermenting after the sugar has been removed, objectionable odors develop and the pH rises due to proteolytic action.

McNally *(14)* indicated that mucin, at a pH of less than 6.0-6.4, is in a compact precipitated form. Slosberg and Stewart *(20)* have shown that mucin plays an important role in the whipping property and angel-cake performance of egg white. These workers found that when egg white is acidified to pH 6.0, there is a definite decrease in these functional properties. Further, the work of Hanson and Stewart *(10)* indicates that mucin must remain in dispersed form in order to obtain an acceptable angel-cake.

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[a] Journal Paper No. J-1460 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 970.

[b] Presented before the Seventh Annual Food Conference, Boston, Mass., June 4, 1947.

According to Stuart and Goresline *(24)* organisms of the coliform group are present in commercial fermenting albumen in such predominating numbers as practically to exclude other bacterial types. On the other hand, these same workers found not only bacteria of the genera *Aerobacter* and *Escherichia* but also members of the groups *Proteus, Serratia,* and *Pseudomonas* persisting in fermenting egg white. Stewart, Best, and Lowe *(21)* described a whole egg fermentation in which *Pseudomonas* readily converted glucose to acid, while Ayres and Kline *(2)* isolated a *Streptococcus* from a highly acid fermentation of egg white. British workers [Hawthorne and Brooks *(11)*] reported a reduction of glucose from 0.5 to .05% in egg white after adding a high level (1%) of the yeast *Saccharomyces apiculatis* and incubating for three hours at 37° C. (98.6° F.).

The numbers and types of organisms that are able to attack carbohydrate in egg white are restricted in large measure by the protective devices resident in native albumen. As early as 1890 Wurtz *(28)* suggested that fresh egg white is, in general, resistant to bacterial attack. By heating the white to 65° to 70° C. (149° to 158° F.), Laschtschenko *(13)* found that germicidal action which it had at temperatures less than 55° to 60° C. (131° to 140° F.) is destroyed and, for that reason, postulated presence of a thermolabile enzyme in the white which is responsible for germicidal action. Turro *(26)* observed that the white of fresh eggs has weaker germicidal action than that of older eggs but it remained for Sharp and Whitaker *(19)* to correlate the rapid rise of pH of egg white after laying with increased bactericidal power of the older eggs.

Another action on bacteria by albumen was brought to light when Fleming *(6)* showed the presence of an agent having the property of lysing certain organisms. He called this material lysozyme. Friedberger and Hoder *(7)* minimized the implication that this factor is, in general, inimical to microorganisms. They found that, of eighty-three air-borne bacteria studied, only one was sensitive to egg white lysozyme. On the other hand, they claimed still another antibacterial action for egg white by maintaining that many of these same organisms, while not lysed, were flocculated by the white.

Balls and Swenson *(4)* postulated presence of an anti-trypsin in egg white. It is suggested that this anti-enzyme might affect the growth of certain organisms in egg white.

Haines *(9)*, after comparing data submitted by Hendrickson and Swann *(12)* and by Friedlein *(8)*, Pucher *(15)*, and Wiley *(27)* hypothesized that the amount of ammoniacal nitrogen in the fresh egg is near or below the limiting concentration that will support good bacterial growth and that the concentration of amino acids is likely to be one of the factors limiting bacterial growth in the fresh egg.

More recently, Eakin, *et al. (5)* isolated the injury-producing protein, avidin, from egg white. They showed that it binds biotin in a stable stoichiometric complex which renders this vitamin unavailable to *Saccharomyces cerevisiae.* In addition, Schade and Caroline *(18)* observed that raw egg white caused an inhibition of the growth of certain microorganisms (including *S. cerevisiae*) independent of the avidin-biotin phenomenon. After ashing yeast extract and testing each of its components, they found that, of these, iron alone was able to overcome this inhibition. Later Alderton, Ward and Fevold *(1)* identified this bacteria-inhibiting, iron-binding protein as conalbumin.

Fermentations by *Streptococci, Aerobacter,* and *Escherichia* produce an egg white that is satisfactory with respect to odor, color and removal of glucose. The resultant product is not satisfactory for angel cake performance, however, because the mucin is precipitated by the acid and is removed. Stuart and Goresline state

that, in commercial fermentations, predominance of bacteria of either the *Aerobacter* or *Escherichia* genus are considered necessary for production of high quality, natural fermented egg white. On the other hand, sterile egg white samples *(25)* inoculated with selected strains of *Serratia, Proteus,* and *Pseudomonas* and allowed to ferment did not show changes in pH, sugar content and formol titration values corresponding to normal, natural fermentations. With these organisms, decreases in pH and sugar content were not pronounced and there was marked proteolytic action by these species. The heavily seeded *Saccharomyces apiculatus* fermentation used by the British workers was objectionable because of the yeasty character of the final product.

None of the various organisms discussed are capable of producing a completely satisfactory fermentation since they either (1) grossly contaminate the product, (2) give rise to objectionable odors and flavors, (3) are in disfavor from a sanitary standpoint, (4) produce an excess of acid, (5) cause loss of mucin, (6) introduce undesirable by-products, or (7) cause protein degradation.

Of the various organisms discussed, yeast appears to have the least undesirable characteristics. For this reason the present investigators chose *Saccharomyces cerevisiae,* or baker's yeast for use in the present studies. While the major purpose of this paper is to illustrate a fermentation not subject to most of the shortcomings listed above, a large portion of the present study is concerned with adaptation of the substrate so that yeast is able to remove sugar from egg white efficiently.

MATERIALS AND METHOD

Egg albumen. Shell eggs were soaked for five minutes in 1% NaOH solution, drained and allowed to air dry. After breaking the egg, the albumen was separated from the yolk and blended sufficiently by use of a Waring Blendor to thoroughly incorporate thick white with thin. In large scale trials, commercially frozen egg white was defrosted overnight at 10° C., decanted in liter amounts and blended as indicated above before use.

Yeast. Saccharomyces cerevisiae was grown in pure culture on malt agar and loop transfers made to malt broth or fresh egg white. Inoculations were made from these to raw egg white. The dry yeast (Fleischmann) used in certain trials was purchased on the open market and was made into a slurry with water (1:4) before inoculation.

Fermentation of egg white. In the early work, loop transfers of yeast cells from malt agar plates were used. This procedure was replaced by the use of wet cell masses from malt broth cultures, and, later, by subcultures from previously fermented egg white. Finally dry yeast was made into a suspension with three parts of water and added to the albumen at a 0.5% level.

The course of the fermentation was followed by pH readings taken from time to time and by making rapid sugar tests. pH readings were taken with a Coleman pH electrometer and presence or absence of glucose was determined by means of the rapid sugar test devised by Stewart and Kline *(23).*

Accessory food factors were added to the albumen separately and in combination. These included yeast extract, yeast extract ash, iron, and biotin. Levels chosen were determined experimentally or were selected on the basis of data in the literature. That amount necessary to overcome inhibition was considered adequate, and ten times the adequate level was considered to be in excess.

To determine the effect of surface/volume ratios on final pH (at sugar-free stage) fermentations were run using 200 ml. of egg white in Erlenmeyer flasks of 200, 250, 500, 1500, and 4000 ml. capacity respectively. In other trials, beakers of

50, 250, 600, 2000, and 4000 ml. volume were filled with inoculated egg white to a depth of 1.8 cm.

For one large scale fermentation, 15 g. of active dry yeast were dissolved in 45 ml. of water and to this 3 g. yeast extract added. The slurry was then mixed with three liters of pre-warmed (30° C., 86° F.) egg white. The incubating egg white was stirred throughout the fermentation period. After all glucose had been removed, one-fourth of this fermented white was added to fresh egg white at a 25% level. This process was repeated twice. Three g. of yeast extract were added to each new batch of albumen at the time of inoculation.

RESULTS

Cells of *Saccharomyces cerevisiae* survive but reproduce very slowly, if at all, when cultured in egg-white. Growth of yeast in albumen is influenced by a number of factors. For example, in the presence of 0.1% yeast extract, there is marked acceleration of glucose conversion in egg white (Table 1).

TABLE 1

Effect of Added Yeast Extract on Rate of Fermentation of Egg White

% Yeast Extract	pH		
	0 hrs.	16 hrs.	24 hrs.
0.01%	8.5	8.8	8.7
0.03%	8.5	7.8	6.9
0.1%	8.5	6.6 [a]	6.7 [a]
0.3%	8.45	6.5 [a]	6.6 [a]
1.0%	8.4	6.4 [a]	6.5 [a]
Control	8.5	8.9	8.8

Yeast inoculum: loop transfer to 50 ml. egg white.
[a] Glucose-free, fermentation complete [rapid sugar test, Stewart and Kline *(23)*].

In their work on the role of iron in growth inhibition of certain organisms, Schade and Caroline observed that corn steep liquor, meat extract and yeast extract, when added in relatively large amounts to nutrient broth in the presence of egg white, permitted growth equal to controls without egg white. They tried a number of the accessory food factors in yeast extract singly and in combination without success until finally they observed that iron overcame inhibition by egg white. No mention was made regarding growth stimulation by iron in the presence of other accessory food factors. From Table 2 it may be seen that iron plus biotin resulted in more rapid fermentation of albumen than did iron or biotin alone. However, even these accessory factors in combination were not as stimulatory as was yeast extract alone. It seems probable that, when large masses of cells are inoculated into

TABLE 2

Effect of Growth Stimulants on Rate of Fermentation of Egg White

	%	pH		
		0 hrs.	16 hrs.	24 hrs.
Yeast extract	1.0%	8.4	6.7 [c]	6.6 [c]
Yeast extract ash	0.1%	8.7	9.0	8.9
Iron [b]	0.02%	8.5	8.5	8.4
Biotin [b]	0.0006%	8.5	8.7	8.7
Iron + biotin		8.5	8.3	7.8
Yeast extract ash + biotin		8.7	9.0	8.4
Control		8.5	8.7	8.7

[b] Added at ten times level reported adequate [Schade *(18)* and Eakin *(5)*].
[c] Glucose-free; fermentation complete. Yeast inoculum: loop transfer to 50 ml. egg white.

albumen, there is sufficient carry-over of these essential food factors (1) to more than saturate demands of the growth inhibiting proteins such as avidin and conalbumin and to thereby provide the nutrients required by the cells to carry on the fermentative processes and (or) (2) to supply other growth factors required and which are not found in egg white.

Rogosa *(16)* has shown that *S. cerevisiae* requires exogenous inositol, thiamine hydrochloride, pyridoxine hydrochloride, d-Ca pantothenate, and biotin for growth. Earlier, this same worker *(17)* indicated that growth of an organism may proceed for one, or even two, transfers, in a deficient medium. Since egg white forms complexes with certain food factors (biotin and iron) making them nutritionally unavailable, this may not hold for this product. In order to provide the accessory food factors for growth and fermentative activity in egg white, it should be possible to hold the population at any desired level simply by incorporating these food adjuncts in the proper concentration.

The speed of fermentation was shown to be proportional to the size of inoculum when wet cell masses or active dry yeast were used. When transfers were made from previously fermenting egg white, the time required to free the albumen of sugar was influenced not only by the number of cells introduced, but also by pH. These effects may result from carry-overs of essential food factors, pH, or both (Table 3).

TABLE 3

Effect of Varying Amounts of Inocula on Fermentation Rate

Hrs.	0%	5% [a]	10% [a]	15% [a]	20% [a]	25% [a]	30% [a]
0	8.7	8.6	8.4	8.3	8.2	8.1	8.0
4	8.7	8.6	8.2	7.5	7.0	6.8	6.6 [b]
5	8.7	8.5	7.7	7.1	6.8	6.6 [b]	
6	8.7	8.4	7.5	6.85	6.6 [b]		
8	8.7	8.3	7.2	6.6 [b]			
12	8.8	8.1	6.6 [b]				
24	8.9	6.6 [b]					

[a] Inoculum consisted of yeast-fermented egg white from previous "run."
[b] Glucose-free; fermentation complete.

pH was shown to affect the rate of fermentation directly (Table 4). Raw egg white ranged from pH 8.0-8.9 at the time of inoculation. In general, fermentations proceeded very slowly when the initial pH was above pH 8.5. Adjusting the pH of raw egg white by addition of a small amount of acid (2 ml. of N. NCl/100 ml. egg white) to pH 7.0 accelerated the rate of fermentation greatly. Much the same purpose was obtained by adding large amounts of previous yeast-fermented egg white.

TABLE 4

Effect of Initial pH on Speed of Removal of Sugar from Egg White

Hrs.	Presence of glucose	
	Sample adjusted to pH 7.0 [c]	Control, pH 8.7
0	+	+
2	0	+
3	—	+
4	—	+
6	—	0

[c] 2 ml. of N HCl/100 ml. egg white.
+ Glucose present.
0 Glucose-free; fermentation complete.
Inoculated with 2% yeast slurry consisting of 1 part dry yeast (Fleischmann's) with 3 parts water.

The minimum pH level was reached at the time when all glucose had been removed and before proteolysis became evident. The amount of acid accumulated at the end of fermentation was shown to depend upon the ratio of surface exposed to the total volume of egg white (Table 5-A and B). These data suggest that carbon dioxide is the principal factor responsible for lowering the pH of albumen being fermented by yeasts.

TABLE 5-A

Effect of Surface to Volume Ratio on pH at the End of Fermentation

Substrate: 200 ml. inoculated egg-white [g]					
Size Erlenmeyer flask, ml	200	250	500	1500	4000
Surface area, sq. cm	4.6	19.3	60	138	290
Ratio of surface/volume	1:43.5	1:10.4	1:3.3	1:1.5	1:1.07
pH when glucose-free	6.0	6.2	6.5	6.8	7.0

TABLE 5-B

Substrate: mls. inoculated egg white [g]	24	65	110	240	380
Size beaker, ml	50	250	600	2000	4000
Surface area, sq. cm	12	33	55	120	190
Ratio of surface/volume	1:2	1:2	1:2	1:2	1:2
pH when glucose-free	6.75	6.75	6.70	6.70	6.70

[g] Inoculated with 25% from a previous yeast fermented egg white. pH at time of inoculation = pH 8.1.

A comparison of results from fermentations having relatively small and large surface areas indicates that pH at the completion of fermentation can be regulated at a level wherein mucin is retained in dispersed form (above pH 6.4). After drying, the pH rose to pH 8.8-9.0, presumably due to the loss of carbon dioxide. The mucin remained dispersed and if dried at low temperatures the albumen reconstituted to give a normal viscous product.

Finally, using the information gained from the small-scale experiments described above, a pilot-scale fermentation was made using dry yeast (Fleischmann). Four successive fermentations were run using one-fourth of the material from each previous lot to the succeeding lot. Results of these trials are shown in Table 6. While the first run, containing 0.5% yeast cells, was quite yeasty, succeeding runs were much more satisfactory.

TABLE 6

Time Required to Complete Serial Fermentations Using Egg White from a Previous Run as Inoculum

Trial	Mls. of raw egg white	Amount of inoculum added	pH after addition of inoculum	Final pH	Time required to remove glucose
I	3000	15g [h]	8.25	6.4	2 hrs.
II	2250	750 ml.	8.0	6.4	2 hrs.
III	2250	750 ml.	8.0	6.4	2 hrs.
IV	2250	750 ml.	8.1	6.4	2½ hrs.

[h] Dry yeast (Fleischmann). Slurry of 1 part yeast with 3 parts water used. 0.1% yeast extract added with each inoculation.

Results of preliminary tests on yeast-fermented albumen indicate that it performs satisfactorily in angel cake (with respect to volume, tenderness and texture), although a slight yeasty odor is present during beating and baking. Studies on the cake-making properties of yeast-fermented, dried albumen, when fresh, and after storage, are underway. Results of these trials will be reported at a later date.

SUMMARY

Yeast *(S. cerevisiae)* is able to remove glucose from egg white rapidly provided yeast extract is added as a growth stimulant. Initial pH of egg white has marked effect on the speed of glucose removal; values below 8.5 greatly accelerated the rate of fermentation.

When large masses of yeast cells are used, the need for yeast extract is obviated. Presumably, sufficient growth factors remain available or are supplied to promote fermentative activity.

By suitable selection of an appropriate surface area, the pH at the glucose-free stage of fermentation may be kept above pH 6.4. This permits fermentation to be accomplished without altering the physical properties of the mucin, and thus permits retaining good angel cake-making properties in the albumen.

Results of large scale trials indicate that this method is commercially feasible.

Additional work is underway to determine whether or not a highly acceptable dried albumen of good keeping qualities can be prepared from yeast-fermented albumen.

ACKNOWLEDGMENT

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ELECTROPHOTOMETRIC METHODS FOR MEASURING RIPENESS AND COLOR OF CANNED PEACHES AND APRICOTS [a, b]

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Results of spectrophotometric and fluorometric methods for the quantitative measurement of extractable pigments from peaches and apricots are presented and the results are correlated with ripeness and color as judged by organoleptic methods.

Ripeness and color are undoubtedly the most important factors of quality in peaches and apricots, as well as other fruits. Although some work is available on the objective measurement of ripeness of raw peaches and apricots, there is no available physical or chemical method that will measure accurately the degree of ripeness or color of the canned product. Color and ripeness are closely associated. In fact, the "undercolor," or ground color is most frequently used to indicate time of harvest *(1, 3)*. Allen *(1)* reports that while the yellow, red, and blue pigments are affected by sunlight, the "breaking" of the green undercolor is independent of sunlight. However, color is not considered as always being an accurate indication of ripeness, inasmuch as under certain conditions all of the visible green color may have disappeared, and the fruit may not yet be fully ripe *(3)*.

Another attempt at measuring the ripeness of peaches and other fruits has been the measurement of firmness through the use of some form of pressure tester, first suggested by Morris *(13)* and developed by Magness, and his coworkers *(10)*. Thus pressure, or firmness tests in pounds or grams, and color descriptions of fruits at various stages of ripeness have been the subjects of numerous reports *(1, 3, 4, 8, 10, 11, 14)* all indicating that the pressure test value decreases as the fruit ripens. As with color, varietal differences were recognized for the results with the pressure test.

Considerable data are available on chemical changes associated with ripening. Lott *(8)* and Tucker and Verner *(14)* showed that sucrose concentration of raw peaches and prunes increases as the firmness of the fruit decreases, while starch, total nitrogen, ash, and hemicellulose content decreases. Appleman and Conrad *(2)* showed that soluble pectin increases in relation to total pectin as peaches ripen. Allen *(1)* reported that electrical conductivity of pears drops off rapidly as the fruit becomes overmature. Similar studies with an "electrical maturity tester" were conducted by Hesse and Schrader on apples *(5)*, and by Moore on pears *(12)*.

Since it is commonly observed that the visible green color progressively disappears as fruits ripen, it was suggested that a quantitative measure of the reduction in the green "undercolor," might be a reliable test of ripeness, if this measurement could be made independently of the prevailing yellow or red color that might be present simultaneously. It was also desired to develop a quantitative method which

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would be closely correlated with organoleptic estimations of color, independently of its possible relationship to ripeness.

METHODS

In developing methods for measuring color in prepared foods it was not considered necessary to determine the total color expression or the exact nature of the pigments involved. It was thought that the relative intensity of some critical pigment could be used as a numerical notation of the color for practical color or ripeness evaluations. The ultimate criterion of the value of such a method, is of course, its relation to organoleptic ratings evaluated statistically.

Since measurements of the reflected color are difficult to make and provide little opportunity for manipulation *(7)*, attempts to place these color measurements on a quantitative basis were limited to transmittance and fluorescence measurements of pigment extracts from the fruit with the thought that satisfactory correlations might be obtained between such measurements and the color and adjudged ripeness of the fruits.

TRANSMITTANCE MEASUREMENTS

Preliminary studies. In order to learn the nature of the pigment in canned apricots and peaches, transmission curves were plotted for the extracts of two samples of apricots—one sample was fully ripe, and the other was still firm. Ten grams of drained, macerated apricots were blended in a Waring Blendor with 75 ml. petroleum ether, for five minutes. The ether layer was then made up to 100 ml. with additional ether, clarified by centrifuging, and the transmission curves shown in figure 1 were plotted employing data obtained from a Coleman monochrometer spectrophotometer in which the effective slit width was 5 mμ.

These data indicate that a measure of the yellow-orange pigment in the ether extract is provided by the transmittance in the absorption band centered at 450 mμ. The small differences in the curves of Fig. 1 at 665 mμ may be assumed to be due to the green pigment concentration in the extract.

When the size of the samples was increased from 10 grams to 90, and the ether extraction was made repeatedly and evaporated to 35 ml. substantial differences between the transmission curves of the extracts from the ripe and the firm sample were obtained. These differences may be seen plotted at the wave length of 665 mμ where the green pigment could be expected to cause a dip in the extract transmission curve. (Fig. 2).

Recommended method. Of all the solvents and combinations of solvents that were tried, ethyl ether proved to be the most efficient for extracting both the green and the yellow-orange pigments. The recommended method is therefore as follows:

1. Drain the can contents [a] for 2 minutes on an 8-mesh screen, and blend the drained peaches in a Waring blendor until they are thoroughly macerated.
2. Weigh 50 grams of the blended material and transfer to a blendor cup with a minimum amount of water, add 200 ml. ethyl ether, and blend five minutes.
3. Transfer the contents of the blendor cup to a 500 ml. separatory funnel, replace the lower layer into the same blendor cup, and the upper ether phase into a narrow necked 500 ml. Erlenmeyer flask.[b]
4. To the contents of the blendor cup add another 100 ml. ethyl ether, blend for 20 seconds, transfer to the same separatory funnel, replace the lower phase into the same blendor cup, and add the ether phase to the Erlenmeyer flask. Repeat this extraction with another 100 ml. ethyl ether.[c]

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[a] In order to reduce evaporation of ether during the blending process, these cans were precooled in 33 degree storage.

[b] Small quantities of water may be used to separate the phases.

[c] For apricots, extract with 100 ml. ether three times.

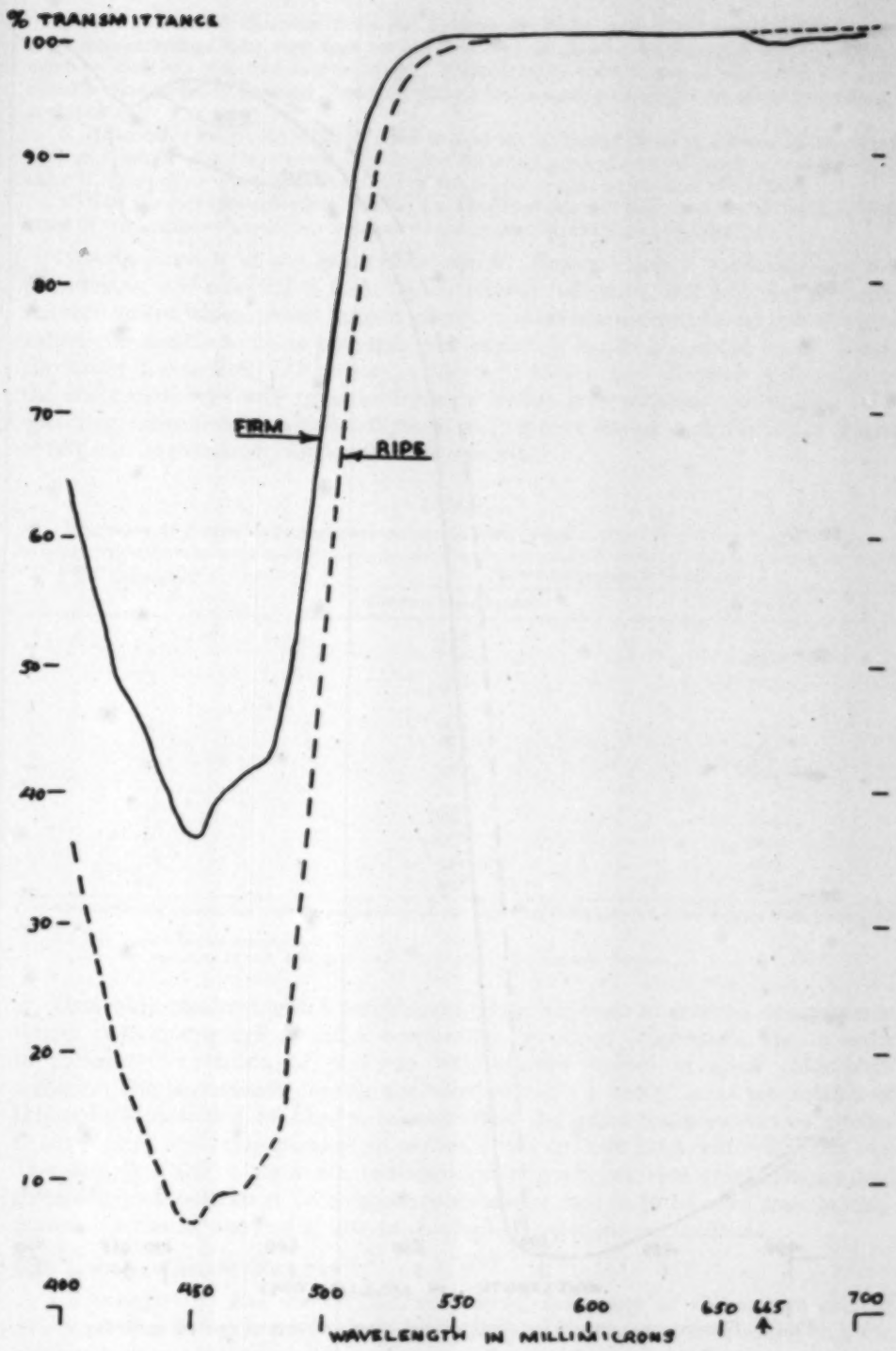

FIG. 1. Transmission curves for ether extracts of canned apricots.

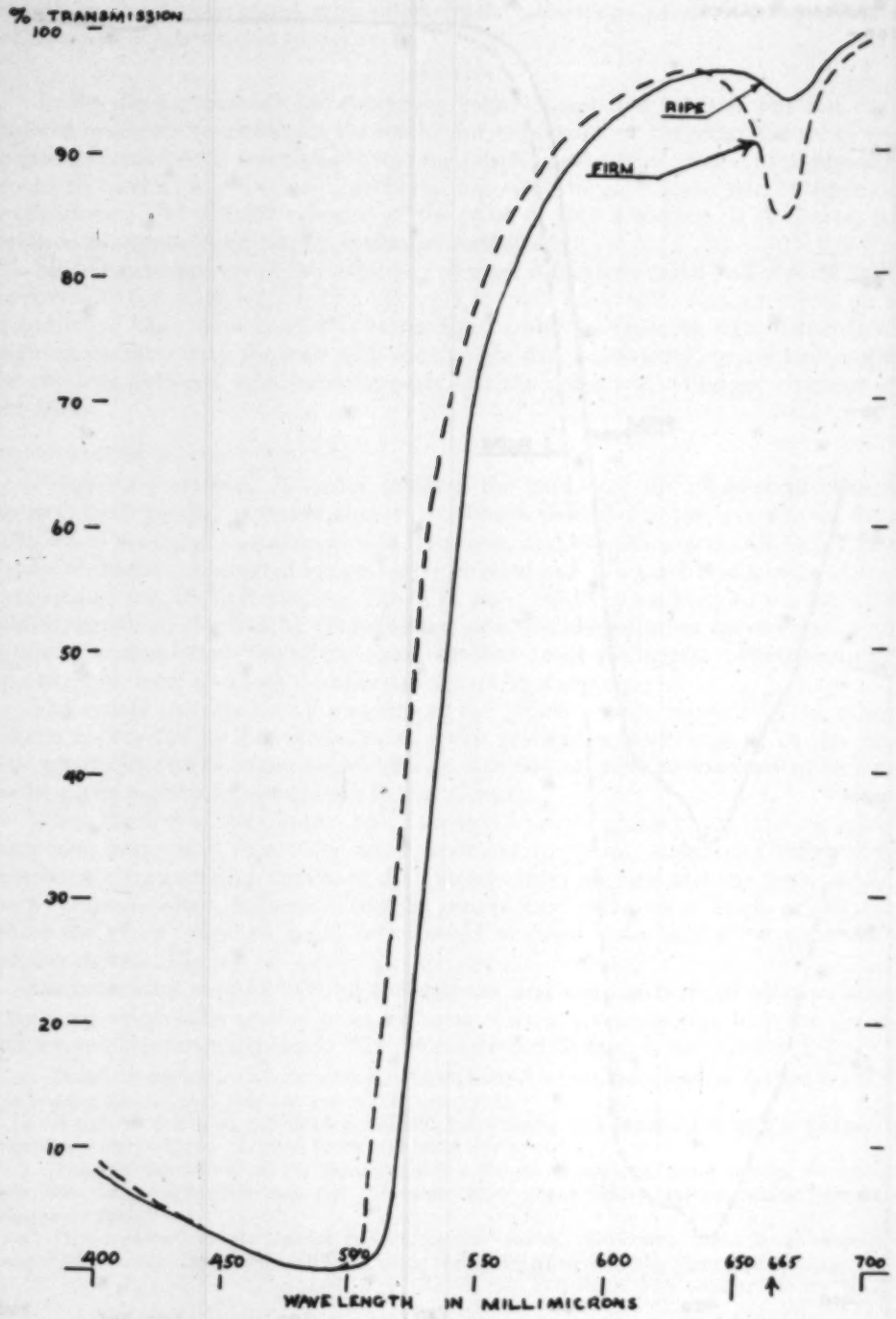

FIG. 2. Transmission curves for concentrated ether extracts of canned apricots.

5. Distill most of the ether from the Erlenmeyer flasks, and transfer the residue into a graduated centrifuge tube with four or five washings of about 5 ml. of ethyl ether each, and make up the clear ether solution to 25 ml. (Ordinarily no centrifuging is necessary, but occasionally some turbidity develops; hence all these samples were centrifuged for about two minutes at this point).

6. Transfer 2 ml. of the ether solution to a 50 ml. graduated flask, and make up to volume with ethyl ether. Use this diluted solution for obtaining percent transmittance at 450 mμ. This value of transmittance provides a measure of the yellow-orange pigment in the extract.[4]

7. Use the concentrated ether solution for obtaining percent transmittance at 665 mμ. This value of transmittance provides a measure of the green pigment in the extract.[4]

Standardization of the spectrophotometer. Before using a particular spectrophotometer, it is essential to have the instrument calibrated, and adjusted properly. An instrument which passes radiant energy in wide wavelength bands will not give values comparable to those obtained with narrower bands of a more nearly monochromatic instrument. Differences in the light source, and diameter and shape of the absorption cells will cause differences in the transmittance values *(7)*. For obtaining transmittance values of peach and apricot extracts at the wave length of 665 mμ, an extremely narrow band is essential.

TABLE 1

Relation of percent transmittance values to chlorophyll content in parts per million [a]

Chlorophyll P. P. M.	Percent transmittance at 665 mμ	
	Coleman monochrometer [b]	Beckman [c]
1	91.0	91.0
2	83.0	84.0
3	75.5	77.5
4	69.1	71.3
5	63.0	65.7
6	57.4	60.4
7	52.3	55.4
8	47.8	51.0
9	43.6	46.9
10	39.8	43.2

[a] Based on the assumption that the preparation of the American Chlorophyll Inc.. is exactly 70% chlorophyll A and B.
[b] Using 5 mμ effective slit width.
[c] Using the standard 10 mm cells, and a slit opening of approximately .03 mm.

Data were obtained with a series of dilutions dispersed in acetone, of a preparation of 70% chlorophyll A and B supplied by American Chlorophyll, Inc. in order to indicate the relation of per cent transmittance values to acual chlorophyll content. The transmission curves for solutions of 1.4 and 7 parts per million of chlorophyll presented in Fig. 3, indicate that the green fruit extract is similar to chlorophyll in its transmission properties, at the spectral band centered at 665 mμ. The data in Table 1 show the relationships between per cent transmittance and chlorophyll concentration. Any spectrophotometer that is to be used may be calibrated in a similar way, using known chlorophyll solutions as standards.

FLUORESCENCE MEASUREMENTS

Kavanaugh *(6)* has shown that very small quantities of chlorophyll can be measured by a two-photocell balanced circuit type fluorometer. Assuming that the extracted green pigment under investigation here is chlorophyll, studies were made

[4] Use pure ethyl ether to calibrate the instrument at 100 percent transmittance.

with a Klett fluorometer with the hope that a smaller sample size could be utilized and consequently the method might be simplified by eliminating a large part of the extracting and concentrating procedure required for the transmittance measurement of extracts of the green pigment.

Preliminary studies. Satisfactory readings of chlorophyll fluorescence could be obtained with the use of lamp filter Corning No. 597, and a photocell filter Corning No. 2404. However, it became apparent that some factor associated with the yellow-orange pigment extracted from the fruits absorbs part of the fluorescence emitted by the chlorophyll. The following study (Table 2) was made in order to determine the effect on the fluorescence values of the yellow-orange pigment at various

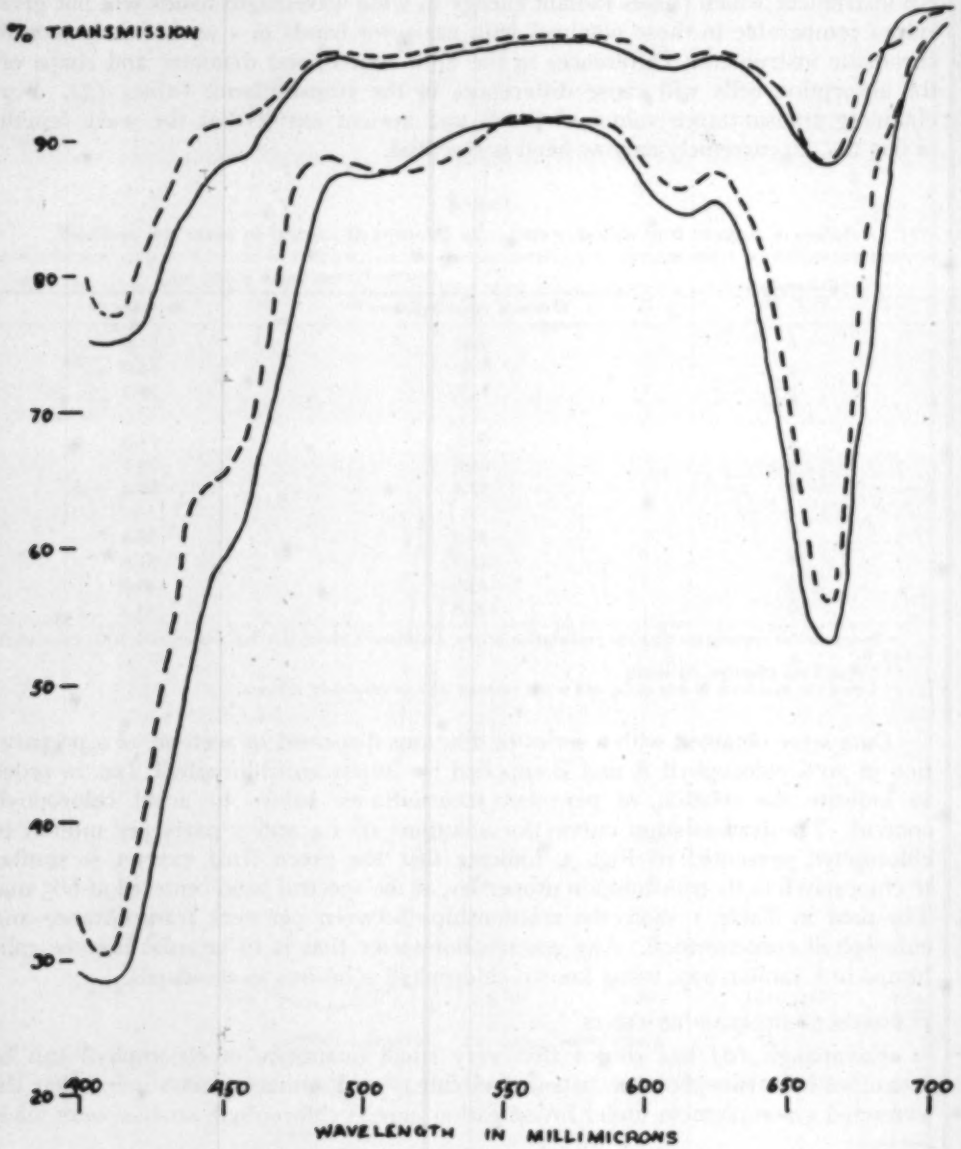

FIG. 3. Transmission curves for solutions of chlorophyll.

dilutions. Four samples of peaches were selected, the extracts of which had approximately the same percent transmittance at 665 mμ (Green pigment), but which differed widely in percent transmittance at 450 mμ (Yellow-orange pigment). For each dilution, the extract of sample 0118, a white peach variety, was measured first, and the slit width was so adjusted that when the instrument was balanced, the fluorescence value would be 100. The other samples were then measured using the same slit width. A solution of quinine sulfate, which might be used under other circumstances for calibration of instruments, was also measured at the same slit widths.

TABLE 2

Effect of dilution on fluorescence of chlorophyll extracted from fruit in the presence of other naturally occurring extracted pigments.

Code	Variety	Percent transmittance		Fluorescence readings dilutions grams per 100 ml.				
		665 mμ (green pigment)	450 mμ (yellow-orange pigment)	40	20	8	3	2
0118	3-34 (white)	68.9	93.0	100	100	100	100	100
0 21	Elberta	68.9	69.0	34	51	73	92	93
0163	Late Cling	69.2	56.1	21	40	75	105	112
6064	Guame (Cling)	69.0	48.0	19	38	73	105	111
Slit opening, %				12.1	10.1	8.5	7.1	6.8
Quinine sulfate, 10 P. P. M.				6.5	13	26	60	78

Thus, as the extract is diluted, the fluorometric values approach equality for all varieties (if due consideration is given to variations among duplicate cans of the same sample). The fluorometric method may therefore serve as a tool which may be adjusted in such a way as to allow the yellow-orange pigment to affect the values to any desired degree, or to the extent that the yellow-orange pigment might be considered to affect organoleptic estimations.

It is apparent, from the above data, that a fluorometric method would be more rapid, since not more than an extract of eight grams of fruit in 100 ml. would be required in contrast to 200 grams per 100 ml. used for the transmittance measurement. Hence, four gram portions of the same four samples were blended in a Waring blendor, with ethyl ether for five minutes, the ether layer was made up to 100 ml., and measured for fluorescence. The results are presented in Table 3. The first column of fluorescence values represents the extracts as measured directly. For the values presented in the second column, the extracts were made up to 150 ml., and in the third, to 200 ml. As previously, for each dilution, the slit width was so adjusted as to result in a value of 100 for the extract of the white peach sample.

In the event that values as determined organoleptically may be found to be affected somewhat by factors associated with the presence of the predominant yellow-orange pigments, then perhaps a dilution can be found which would agree more closely with organoleptic estimates of ripeness than would a fluorescence measurement of more dilute solutions, or a transmittance measurement in the spectral band centered at 665 mμ, neither of which measurements appear to be significantly affected by the presence of the yellow-orange pigments.

Recommended method. The sample size that will be selected eventually will depend on the degree to which the yellow-orange pigments are found to affect organoleptic estimates; however, the following method is suggested on a tentative basis:

1. Drain the can contents, and blend the drained fruit in a Waring blendor to a uniform pulp.

TABLE 3

Effect of dilution on fluorescence of chlorophyll in ether extracts of peaches, prepared by a rapid method.

Code	Variety	Percent transmittance		Fluorescence readings dilutions grams per 100 ml.		
		665 mμ (green pigment)	450 mμ (yellow-orange pigment)	4	3	2
0118	3-34 (white)	68.9	93.0	100	100	100
0 21	Elberta	68.9	69.0	87	92	92
7163	Late Cling	69.2	56.1	93	99	102
6064	Guame (cling)	69.0	48.0	88	94	99
Slit width, %				7.5	7.0	6.8
Quinine sulfate, 10 P. P. M.				49	63	78

2. Weigh five grams of the blended material, and transfer to a blendor cup with a minimum amount of water, add 100 ml. ethyl ether, and blend for five minutes.

3. Transfer the contents to a graduated cylinder, make up the volume of the ether layer to 100 ml.

4. Fill the 50 x 10 mm glass cell of the Klett fluorometer with the ether solution, and measure, using lamp filter Corning No. 597, and photocell filter No. 2404. Set the slit width to 8.0 percent for peaches, and 7.5 for apricots.

It is evident that the above procedure is many times simpler and more rapid than that required for percent transmittance measurement at 665 mμ.

Standardization of the fluorometer. The data in Table 4 show the relationship of the concentration of chlorophyll A and B to the fluorescence readings when the slit width is adjusted to 8.0 percent and 7.5, as for peaches and apricots, respectively.

TABLE 4

Relation of fluorescence values to chlorophyll contents in parts per million.[a]

Chlorophyll P. P. M.	Fluorescence readings	
	Peaches slit 8.0%	Apricots slit 7.5%
0.00	5	10
0.01	12	19
0.02	19	27
0.03	25	36
0.04	32	45
0.05	39	54
0.06	45	63
0.07	52	72
0.08	59	81
0.09	65	90
0.10	72	99
0.12	85	116
0.14	98	134
0.16	111	151
0.18	125	169
0.20	138	186
0.25	171	228
0.30	203	270

[a] Based on the assumption that the preparation supplied by the American Chlorophyll Inc. is exactly 70% chlorophyll A and B.

Fluorescence readings for the fruit extracts, however, cannot be directly calculated in terms of chlorophyll, since no adjustment is made for the masking effect of the yellow-orange pigments extracted from the fruit. However, a standardized chlorophyll solution can be used to adjust the instrument to the proper slit width.

The instrument may also be standardized by means of a solution of quinine sulfate, which fluoresces over a wide range of the spectrum. Table 5 gives the fluorescence values at different slit widths of a solution of 10 parts per million of quinine sulfate in 0.1 normal sulfuric acid.

It thus appears, that the slit width should be adjusted so as to give a reading of 35 for the standard solution of quinine sulfate for peaches, and 49 for apricots.

RESULTS

Considerable data have been accumulated on experimental samples of peaches and apricots prepared during the 1945 and 1946 seasons, which showed that the two previously described methods of measuring ripeness were closely correlated with organoleptic values. Because of considerations of space only the following typical data are presented.

TABLE 5

Relation of slit width to fluorescence values of quinine sulfate.

Slit width percent	Fluorescence readings for Quinine sulfate, 10 P.P.M.
12.0	7.0
11.0	9.0
10.0	12.5
9.0	20.0
8.5	26.0
8.0	35.0
7.5	49.0
7.0	64.0
6.5	100.0
6.0	180.0

TABLE 6

Effect of the date of harvest on firmness and on transmittance and fluorescence measurements of ether extracts of canned peaches.

Variety	Date of Harvest	Pressure Test (lbs.)	Percent transmittance		Fluorescence (8 grams/100 ml. slit width 9.0%)
			665 mμ (green pigment)	450 mμ (yellow-orange pigment)	
Golden Jubilee	July 27	12.6	56.6	80.0	124
Golden Jubilee	July 29	11.5	59.5		96
Golden Jubilee	July 31	9.8	65.5	73.3	79
Golden Jubilee	Aug. 2	7.5	85.8	62.5	27
Golden Globe	July 30	19.6	40.2	73.4	153
Golden Globe	Aug. 1	12.8	56.5	74.5	135
Golden Globe	Aug. 3	16.2	45.6	76.9	126
Golden Globe	Aug. 5	10.9	61.9	71.3	102
Golden Globe	Aug. 8	10.0	72.9	64.0	57
Md. 3-34 (white)	July 31	20.5	33.6	94.0	278
Md. 3-34 (white)	Aug. 2	20.4	45.6	92.4	230
Md. 3-34 (white)	Aug. 4	16.3	48.9	93.2	223
Md. 3-34 (white)	Aug. 7	12.1	70.4	95.7	97

Date of harvest. Wedge-shaped portions of peach trees were harvested at two to three day intervals at the plant research farm of the University of Maryland. The fruit from each harvest was canned separately, and the photometric analyses of fruit extracts were made during October-November, 1946. The results are presented in Table 6, and show that as the harvest was delayed, the extractable green pigment content was reduced as indicated by the transmittance and fluorescence methods, and the extractable yellow-orange pigment content increased for the yellow varieties. It is interesting to note that the slight trace of yellow-orange pigment in the one experiment with white peaches tended to decrease with ripening.

Storage of the raw fruit. The data in Table 7, show that raw peaches held in common storage also lose extractable green pigment while the predominant extractable yellow-orange pigment increases.

Selection of the raw fruit. The data presented in Tables 8, 9, and 10, for freestone peaches, clingstone peaches and apricots, respectively, are for samples that were prepared by choosing specially selected halves. For each series of samples, the ripest halves were selected for the full ripe sample, and the greenest for the last sample in the series, and halves that were judged as intermediate in ripeness, for the intermediate samples. The data in these tables therefore provide the opportunity for comparing the judgment of the degree of ripeness of the raw halves to the photometric determinations.

TABLE 7

Effect of length of storage of raw peaches after harvesting on photometric measurements of extracts of canned peaches.

Variety	Storage Hours	Percent transmittance		Fluorescence (8 grams/100 ml. slit width 9.0%)
		665 mμ (green pigment)	450 mμ (yellow-orange pigment)	
Elberta	24	69	75	62
Elberta	48	80	76	41
Elberta	72	86	73	28
Hale Haven	24	57	66	84
Hale Haven	48	69	69	58
Hale Haven	72	84	60	29
Golden Jubi	0	41	77	169
Golden Jubi	48	59	73	92
Golden Jubi	0	65	77	85
Golden Jubi	24	70	74	69
Golden Jubi	0	69	72	69
Golden Jubi	24	79	68	46
Golden Globe	0	30	78	229
Golden Globe	24	36	79	201
Golden Globe	48	47	73	157
Golden Globe	0	49	63	96
Golden Globe	24	58	52	74
Golden Globe	48	65	56	62
Golden Globe	0	58	63	77
Golden Globe	24	67	57	46
Golden Globe	48	72	47	39

TABLE 8

Freestone peaches. Relation of ripeness of selected raw halves to photometric measurements on extracts of the canned product.

Variety	Location	Description of ripeness of the raw halves	Percent transmittance		Fluorescence (8 grams/100 ml. slit width 9.0%)
			665 mμ (green pigment)	450 mμ (yellow-orange pigment)	
Elberta	Georgia	Ripest	85	71	46
		Ripe	81	75	---
		Firm	68	77	92
		Firm-green	54	77	---
		Green	34	78	270
Hale Haven	South Carolina	Riper selected	76	64	42
		Orchard run	69	69	58
		Greener selected	54	75	114
Elberta	Michigan	Ripe	77	68	42
		Firm	66	75	74
		Firm-green	45	79	142
		Too green	42	78	166
Elberta	Washington	Ripe	89	58	16
		Average ripe	83	66	23
		Bottom firm	75	68	39
		Too green	70	63	53
Elberta	California	Soft ripe	97	63	11
		Ripe	96	66	14
		Bottom ripe	88	69	29
		Too green	72	72	74

TABLE 9

Clingstone peaches. Relation of ripeness of selected raw halves to photometric measurements on extracts of the canned product.

Variety	Location	Description of ripeness of the raw halves	Percent transmittance		Fluorescence (5 grams/100 ml. slit width 8.0%)
			665 mμ (green pigment)	450 mμ (yellow-orange pigment)	
Early Midsummer	California	Ripe	96	30	22
		Bottom ripe	77	52	68
		Bottom firm	53	56	154
		Too green	38	58	174
Guame	California	Ripe	90	22	20
		Bottom ripe	71	57	68
		Bottom firm	69	48	70
		Too green	68	44	76
Sims	California	Ripe	91	38	19
		Bottom	89	49	30
		Firm	66	48	55
		Too green	54	52	98
Phillips	California	Ripe	98	56	17
		Bottom ripe	73	56	55
		Bottom firm	80	61	49
		Too green	72	57	71
Amber Gen	Sou. Carolina	Ripest	97	44	15
		Ripe	95	45	18
		Firm	87	55	30
		Too green	77	60	58

TABLE 10

Apricots. Relation of ripeness of selected raw apricots to photometric measurements on extracts of the canned product (all the samples were prepared in California).

Variety	Style of pack	Description of ripeness of the raw halves	Percent transmittance		Fluorescence (5 grams/100 ml. slit width 7.5%)
			665 mμ (green pigment)	450 mμ (yellow-orange pigment)	
Tilton	Halves	Soft ripe	87	25	42
		Ripe	84	42	58
		Bottom firm	71	54	99
		Too green	66	69	139
		Soft ripe	87	36	46
		Ripe	84	40	58
		Bottom firm	77	52	128
		Too green			
	Whole, unpeeled	Ripe	92	21	38
		Bottom firm	61	63	140
	Whole, peeled	Ripe	92	30	38
		Bottom firm	90	60	42
Blenheim	Halves	Soft ripe	88	25	40
		Ripe	80	41	70
		Bottom firm	69	35	149
		Too green	72	65	103
		Soft ripe	82	19	34
		Ripe	81	24	55
		Firm	75	41	95
		Bottom firm	67	42	121
		Too green	61	47	142
	Whole, unpeeled	Ripe	82	26	64
		Bottom firm	60	43	110
	Whole, peeled	Ripe	81	21	49
		Bottom	72	45	75

SUMMARY

Spectrophotometric and fluorometric methods are presented for measuring quantitatively the extractable green pigments from peaches and apricots. Both of these methods reflect accurately slight variations in the green pigment content of peaches and apricots which occur with varying degrees of adjudged ripeness. The transmittance method is longer and more tedious but provides a means of measuring the extractable green pigment independently in the presence of other pigments simultaneously extracted from the fruits. The fluorometric method, is affected by the presence of the extracted yellow-orange pigment, but the effect is minimized by dilution of the sample to be measured. A spectrophotometric method for measuring the extractable portion of the predominant yellow-orange pigment is also presented.

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COMPOSITION AND NUTRITIVE VALUE OF HAMS AS AFFECTED BY METHOD OF CURING

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Changes in the character of fat, the protein and vitamin content, and nutritive value are correlated with the curing method and length of storage to which hams are subjected. Some of these changes are related to changes in moisture content, others to chemical changes in composition.

Hams constitute approximately 19 percent of the total weight and 29 percent of the lean meat of the chilled carcasses of hogs weighing 225 pounds. Hogs of about that weight make up a large proportion of those marketed in the United States. Approximately 29 percent of the protein and 15 percent of the energy value of the carcasses are found in the hams, according to Hankins and Ellis *(2)*. Since most of the hams from hogs slaughtered in the United States are cured and smoked, it is important to know the effects of different methods of curing and the effects of storage on the composition and nutritive value of the product. The experiments herein reported were conducted to obtain information on this subject.

PREVIOUS INVESTIGATIONS

Supplee and Broughton *(7)* studied the changes taking place in the fat of home-cured hams when stored at room temperature for periods ranging from 1 to 24 months. The percent of free fat acids in the intramuscular fat increased from 4.7 to 25.7, and that in the external fat increased from 4 to 17.3 percent. The moisture content of the muscle tissue or lean meat decreased from 58.3 to 38.9 percent, and that of the external fatty tissues decreased from 8.7 to 2.9 percent.

Feeding tests with rats on diets containing 13.5 percent of free fat acids prepared from lard, as compared with similar tests with diets containing 15 percent of lard, indicated that this proportion of free fat acids was as well utilized by the rats as the corresponding percentage of lard.

Hunt, Supplee, Meade, and Carmichael *(4)* studied the effects of aging cured hams. The shrinkage in weight ranged from 1.39 percent after storage for 0.4 month to 20.44 percent at the end of 24.3 months. The moisture content of the lean meat decreased from 57 to 39.6 percent. The free fat acids in the internal fat increased from 5.5 percent after storage for 0.5 month to 24.5 percent after storage for 24 months. The free fat acids in the external fat increased from 3.9 to 18.8 percent during the same period. The salt content ranged from 5.7 percent in hams stored 1 month to 8.4 percent in hams stored 24 months.

Schweigert, McIntire, and Elvehjem *(6)* determined the retention of thiamine, riboflavin, and nicotinic acid by hams cured for 13 days in brine. The hams were first injected with brine amounting to 8 percent of the weight of the hams. Four pairs of hams were used, one ham of each pair being analyzed before curing, the other after curing. When calculated on the basis of the vitamin content per gram of protein, 85 percent of the thiamine, 104 percent of the riboflavin, and 106 percent of the nicotinic acid were retained by the cured hams.

Jackson, Crook, Malone, and Drake *(5)* determined the retention of thiamine, riboflavin, and niacin in curing bacon. The average percentage retention of vitamins

by brine-cured sides was as follows: thiamine, 74.1; riboflavin, 89.0; and niacin, 80.8 percent. With dry-cured backs 85 percent of the thiamine, 57.9 percent of the riboflavin, and 95.9 percent of the niacin were retained.

EXPERIMENTAL PROCEDURE

The hams from 42 hogs were used in this study. All hogs were full-fed on rations consisting basically of corn or wheat, supplemented with protein concentrates and minerals. The final feedlot weight of each animal was approximately 225 pounds.

In dressing, the carcasses were split down the center to the head, which was left on; the leaf fat was pulled loose, but allowed to remain hanging from the flank end; and the hams were not faced. The carcasses were chilled for about 96 hours at a temperature of approximately 35° F. (1.6° C.). All carcasses except two were classed as "hard." One of the exceptions was "medium hard," and the other was "medium soft."

When removed from the remainder of the carcass, the hams were cut slightly long to facilitate arterial injection. The feet were removed at the hock joint, surplus fat was trimmed from the face of the hams, and the corners were rounded moderately. The trimmed hams ranged in weight from 15.5 to 19.4 pounds in the first experiment, and from 14.2 to 19.5 pounds in the second experiment.

Six hams were selected to represent each group of 42 in the fresh, uncured state. These hams were used for the determination of certain composition factors and nutritive properties. The 36 remaining hams in each experiment were divided into 3 groups of 12 each. In making these selections, as well as that of the 6 hams, a systematic plan was followed and full advantage was taken of the opportunity for pairing. The 3 groups of hams were processed as follows:

Artery-cured hams. The hams were injected through the iliac artery with curing solution sufficient to increase the weight of each ham about 10 percent. The solution was made up in the proportion of salt 32.1, sugar 8, potassium nitrate 0.5, and water 100 pounds. The brine (pickle) was boiled, loss being made up by the addition of boiled water, and chilled to 38° F. (3.3° C.). After injection, the hams were immersed for 15 days in brine made up in the following proportions: salt, 8 pounds; sugar, 2 pounds; potassium nitrate, 2 ounces; and water, 36 pounds. The 12 hams were packed in a 50-gallon tierce with approximately 164 pounds of brine.[a] The temperature during the curing period was 36° — 38° F. (2.2° — 3.3° C.).

Dry-cured hams. These hams were cured with a mixture composed of salt, 8 pounds; sugar, 2 pounds; and potassium nitrate, 2 ounces, per 100 pounds of fresh meat. One-half of the total quantity of dry mixture was applied at the beginning of the curing period, one-fourth when the meat was overhauled on the third day, and the remainder on the tenth day when overhauling was done again. The temperature during the curing period was 36° — 38° F. (2.2° — 3.3° C.). The hams were cured in a 50-gallon tierce for 2 days per pound of mean fresh weight.

Brine-cured hams. These hams were immersed in a curing solution made up in the proportions of salt, 8 pounds; sugar, 2 pounds; potassium nitrate, 2 ounces; and water 36 pounds. To cover the 12 hams in a 50-gallon tierce, 164 pounds of solution were required in the first test and 159 pounds for those in the second test.

When the curing was completed, the hams cured by each of the 3 methods were washed in water at 110° F. (43° C.) to remove surface salt, hung up to dry, and smoked for about 15 hours at a smokehouse temperature of approximately 115° F. (46° C.).

[a] The artery injection of brine into hams, followed by their immersion in brine in curing, is described in U. S. Patent No. 1951436.

When the curing was begun samples of the brine used for the injection and immersion of the hams were taken for analysis. At the end of the curing period all brine from each group of hams was weighed and a sample was taken for analysis.

When the 3 groups of 12 hams each had been smoked in each experiment, 4 representative hams from each group were selected for immediate study with respect to composition and nutritive properties. The other 8 hams were stored, without wrapping, at 68° F. (20° C.) and were so hung in the room that there was opportunity for free circulation of air. Four hams were removed for study after 16 weeks and the last 4 after 32 weeks of storage.

At each of the 5 stages including (1) fresh, (2) cured, (3) smoked, (4) stored for 16 weeks, and (5) stored for 32 weeks, weights were obtained as a basis for calculating gains and losses in processing and storage. Representative hams were subjected to physical analysis involving the determination of the proportions of separable fat, lean, skin, and bone. Additional weights were taken of the artery-cured hams after injection. The lean meat from each ham was ground through a 0.25-inch plate, thoroughly mixed, and sampled for analysis. The remaining lean meat from each group of 6 fresh hams and from the various sets of 4 hams, representing the different methods of curing and periods of storage, was then well mixed and approximately 16 pounds were taken for cooking. This meat was placed as loaves in suitable containers and heated to an internal temperature of 155° F. (68° C.) at an oven temperature of 325° to 350° F. (163° — 177° C.). The cooked meat was dehydrated to a moisture content of not more than 10 percent in a drier of the circulating-air type operated at 155° F. (68° C.).

The dehydrated meat was thoroughly extracted with ethyl ether at room temperature and was then heated a few hours in an oven in a current of air at a maximum temperature of 140° F. (60° C.). The extracted dried meat was ground fine and stored in tightly covered jars at approximately 23° F. (— 5.0° C.). The ether extract from the meat of the hams was distilled until the fat was nearly free of ether, when the extract was heated in a vacuum to remove the last trace of solvent. The fat samples were stored in tightly covered containers at 34° F. (1.1° C.) for subsequent study with respect to deterioration during the curing and storage of the hams. All lots of extracted, dehydrated ham were analyzed for moisture, ash, sodium chloride, nitrogen, and fat.

The separable fat from each of the 10 sets of hams in the first experiment was ground and rendered in a steam-jacketed kettle. The temperature of the fat did not exceed 255° F. (124° C.). These samples of fat were stored under the same conditions and for the same purpose as those of the intramuscular fat mentioned above, and for study in relation to growth-promoting value.

METHODS OF ANALYSIS

The methods followed were in general those approved by the Association of Official Agricultural Chemists *(1)*, unless otherwise stated. In the determination of nitrogen, selenium was used as a catalyst. The Kreis test for rancidity was conducted in the usual manner with 5 ml. portions of melted fat, hydrochloric acid, and a 0.1 percent solution of phloroglucinol in ether.

Thiamine was determined by the method outlined in the First U. S. P. XII Bound Supplement *(8)* with modifications suitable for use with meat. The meat was prepared in a Waring blendor. The samples were digested 1 hour on a steam bath and were then incubated 3 hours with pepsin at 38° C. followed by incubation over night with taka diastase at the same temperature. The mixture was filtered through glass wool and made to a volume of 100 ml. Aliquots of the clear filtrate were used for oxidation without passing through the base-exchange tube.

DIETS AND FEEDING TESTS

In the determination of the biological value and digestibility of the protein in hams, the diets for rats were made up essentially as previously described by the writers *(3)*. On account of variations in the sodium chloride content of different lots of hams, the salt content of each diet in a series was adjusted to the same level.

In the determination of the growth-promoting value of the rendered separable fat from the hams, the diets were made up as follows: 15 percent of each lot of ham fat was added to a diet and in addition 1 percent of lard containing sufficient fat-soluble vitamins so that 1 gm. of diet would contain 5 International units of vitamin A, 1 unit of vitamin D, and 20 mcg. of alpha-tocopherol. The B vitamins were added in the quantities previously reported by the writers *(3)*. Sufficient ether-extracted, dehydrated cured ham was added to supply 12.5 percent of protein. The following amino acids were added to certain diets: l (—) cystine, dl methionine, and l (—) tryptophane. Salt mixture amounting to 2 percent and sufficient dextrose to make 100 percent completed the diet.

The feeding and digestion tests were conducted with young male albino rats as previously described by the writers *(3)*.

RESULTS

WEIGHTS AND PHYSICAL COMPOSITION OF HAMS

Table 1 shows the changes in weight, in terms of both pounds and percentage, that occurred in the hams during processing and storage. It is of interest that the increases of approximately 12 and 11 percent resulting from the injection of brine in the first and second experiments, respectively, were followed by further increases of about 4 percent during immersion. The method of smoking employed did not reduce the weight of the artery-cured hams in either experiment to that of the fresh hams, whereas the dry-cured hams lost about 9 percent and the brine-cured hams somewhat more than 3 percent from fresh to smoked weight.

After 32 weeks of storage the artery-cured hams showed a net yield of between 82 and 83 percent. The dry-cured hams averaged 75.7 and the brine-cured hams 77 percent of fresh weight at the end of the same period of storage.

Table 1 also shows the physical composition of the fresh, cured, smoked, and stored hams. With 29.50 and 33.05 percent of separable fat in the fresh hams of the two experiments, represented by a mean of 31.28 percent, the artery-cured hams showed a decrease in separable fat at the smoked stage. This was accompanied by a decrease in the proportion of bone and increases in the proportions of lean meat and skin. On the other hand, the dry-cured hams showed an increase in the proportion of fat and a decrease in that of lean meat between the fresh and smoked stages. The results for the brine-cured hams were inconsistent, but the mean values for the 2 experiments indicate an increase in the proportion of fat and a decrease in lean meat content.

The apparent changes that took place in the proportions of lean, fat, skin, and bone were due chiefly to changes in the moisture content of the tissues and, to a minor extent, to the absorption of curing ingredients.

COMPOSITION OF PICKLE AND LOSS OF PROTEIN

The partial chemical composition of the pickle is shown in Table 2. In each experiment the used pickle from the dry-cured hams contained the highest percentages of both total and coagulable protein, whereas the lowest percentages were found in the pickle from the artery-cured hams. In the used pickle from each cure,

TABLE 1

Average weights and physical composition of artery-, dry-, and brine-cured hams at different stages of processing and storage

Item	Experiment No. 1				Experiment No. 2			
	Fresh	Artery	Dry	Brine	Fresh	Artery	Dry	Brine
Total number of hams	6	12	12	12	6	12	12	12
Weight	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*
Fresh	17.23	17.39	17.81	17.48	16.58	16.72	16.55	16.92
Injected		19.47				18.49		
Cured [1]		20.12	17.13	18.52		19.16	16.18	18.03
Smoked [2]		18.64	16.23	17.05		17.42	15.08	16.20
Stored 16 weeks (8 hams)		15.16	14.09	14.25		14.86	13.30	14.08
Stored 32 weeks (4 hams)		14.60	13.78	13.95		13.80	12.62	12.52
Weight in relation to fresh weight	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
Injected		111.96				110.66		
Cured [1]		115.66	96.22	105.97		114.61	97.61	106.69
Smoked [2]		107.17	91.12	97.56		104.25	91.00	95.71
Stored 16 weeks		87.87	79.20	80.89		88.70	78.99	81.65
Stored 32 weeks		82.48	76.44	77.64		82.82	75.04	76.31
Fresh Hams								
Physical composition								
Fat	29.50				33.05			
Lean	56.80				54.01			
Skin	3.86				3.97			
Bone	9.84				8.97			
Smoked Hams								
Fat		27.02	33.75	36.46		27.21	35.91	30.58
Lean		58.88	51.15	50.85		59.76	49.44	56.50
Skin		6.46	6.20	4.61		4.77	6.27	4.77
Bone		7.64	8.90	8.08		8.26	8.38	8.15
Stored Hams—16 Weeks								
Fat		29.06	35.20	31.25		29.45	36.93	31.74
Lean		53.83	46.84	51.47		55.88	48.70	53.14
Skin		7.02	6.60	7.08		5.63	5.65	6.24
Bone		10.09	11.36	10.20		9.04	8.72	8.88
Stored Hams—32 Weeks								
Fat		37.21	39.63	38.72		35.66	41.97	36.52
Lean		47.31	44.53	46.19		49.35	41.81	47.71
Skin		7.01	6.58	6.07		6.22	6.53	6.41
Bone		8.47	9.26	9.02		8.77	9.69	9.36

[1] "Cured" as used in this table means that curing was done without subsequent smoking.

[2] "Smoked" implies that curing preceded the smoking operation.

the coagulable protein amounted to approximately one-fourth of the total protein. The coagulable protein represents true protein, but the non-coagulable protein consists largely of meat bases.

The calculated losses of total and coagulable protein from 12 hams cured by each of 3 methods in 2 experiments are shown in Table 3. The percentage losses are calculated on the basis of the total quantity of protein in the lean meat from the cured and smoked hams and the quantities of total and coagulable protein in the used pickle. The average losses of total protein for the 2 experiments range from 1.35 percent from the dry-cured hams to 5.19 percent from the brine-cured hams. The losses of coagulable protein range from 0.33 percent from the dry-cured hams to

TABLE 2

Chemical composition of pickle used in ham curing experiments

Description of pickle	Curing period	Specific gravity at 15° C.	Sodium chloride	Total protein	Coagulable protein
	Days		*Percent*	*Percent*	*Percent*
Experiment No. 1					
New immersion pickle		1.135	15.39		
Injection pickle		1.171	19.47		
Used pickle from artery cure	15	1.125	13.64	0.31	0.08
Used pickle from dry cure	37	1.251	22.53	1.13	0.27
Used pickle from brine cure	71	1.107	12.14	0.75	0.17
Experiment No. 2					
New immersion pickle		1.151	16.82		
Injection pickle		1.180	19.94		
Used pickle from artery cure	15	1.138	14.87	0.35	0.09
Used pickle from dry cure	34	1.244	22.73	1.25	0.34
Used pickle from brine cure	67	1.120	12.33	0.75	0.15

TABLE 3

Loss of protein from 12 hams during cure

Method of cure	Lean meat in cured hams	Total protein in cured hams		Weight of used pickle	Protein in pickle from cured hams		Loss of protein in pickle from cured hams	
					Total	Coagulable	Total	Coagulable
	Pounds	*Percent*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Percent*	*Percent*
Experiment No. 1								
Artery	131.51	17.77	23.37	155.5	0.48	0.12	2.05	0.51
Dry	99.53	22.64	22.53	26.4	.30	.07	1.33	.31
Brine	103.73	20.31	21.07	142.5	1.07	.24	5.08	1.14
Experiment No. 2								
Artery	124.60	18.35	22.86	152.0	.53	.14	2.32	.61
Dry	89.27	22.83	20.38	22.0	.28	.07	1.37	.34
Brine	109.62	20.47	22.44	159.0	1.19	.24	5.30	1.07
Average Experiments Nos. 1 and 2								
Artery							2.19	.56
Dry							1.35	.33
Brine							5.19	1.11

1.11 percent from the brine-cured hams. These losses represent actual wastage of protein, but the percentage losses of true protein are relatively small.

COMPOSITION OF HAMS

The chemical composition of the lean meat from the fresh and cured hams is shown in Table 4. The data for each lot of fresh hams are averages for 6 hams and those for cured hams are averages for 4 hams.

The data for moisture indicate that, in each experiment, each lot of cured hams contained less moisture at the end of cure than was present in the fresh hams. The artery-cured hams contained the most moisture and the dry-cured hams contained the least. After storage for 112 days there was a marked reduction in the moisture content of each lot of hams, followed by smaller losses during an additional storage period of 112 days. The total losses of moisture ranged from approximately 21 to 24 percent in experiment No. 1 and from 20 to 27 percent in experiment No. 2. When the moisture content was calculated on the salt-free basis, the percentage of

TABLE 4

Average chemical composition of lean meat from fresh hams and from cured hams before and after storage

Method of cure	Curing period	Storage period	Moisture	Moisture (salt-free basis)	Ash	Sodium chloride	Protein	Fat	Thiamine			Fuel value per 100 gms.
									Per 1 gm. meat	Per 1 gm. protein	Apparent loss [1]	
	Days	*Days*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Micrograms*	*Micrograms*	*Percent*	*Calories*
Experiment No. 1												
Fresh			73.65		1.05		19.38	5.97	8.74	45.05		131
Artery	15		69.13	73.08	6.12	5.41	17.77	5.83	6.34	35.68	20.8	124
Dry	37		61.98	64.75	5.20	4.28	22.64	8.44	7.60	33.61	25.4	167
Brine	71		63.99	68.08	6.57	6.01	20.31	7.59	5.19	25.48	43.4	150
Artery	15	112	56.05	61.48	9.45	8.83	21.94	10.37	6.45	29.79	33.9	181
Dry	37	112	51.15	54.44	7.14	6.04	25.77	14.36	8.52	33.06	26.6	232
Brine	71	112	52.86	57.81	9.55	8.57	24.53	11.54	6.13	25.12	44.2	202
Artery	15	224	52.57	57.78	10.07	9.01	24.14	11.46	7.84	32.32	28.3	200
Dry	37	224	49.88	53.30	7.59	6.41	28.88	12.84	8.00	27.83	38.2	231
Brine	71	224	50.42	55.92	10.77	9.83	27.19	10.11	7.35	27.12	39.8	200
Experiment No. 2												
Fresh			71.64		1.08		19.94	7.32	7.80	39.16		146
Artery	15		66.87	71.16	6.82	6.03	18.35	6.78	6.54	35.67	8.9	134
Dry	34		61.87	64.42	6.19	5.51	22.83	7.72	8.74	38.31	2.2	170
Brine	67		62.92	67.61	7.71	6.93	20.47	7.75	7.32	35.81	8.6	152
Artery	15	112	57.47	62.24	8.65	7.66	22.46	10.09	6.30	28.00	28.5	181
Dry	34	112	50.96	54.86	8.30	7.11	27.42	11.83	8.14	29.74	24.1	216
Brine	67	112	53.77	58.64	9.31	8.31	25.24	10.43	7.27	28.85	26.3	195
Artery	15	224	51.50	56.76	10.26	9.27	23.95	12.21	8.03	33.63	14.1	206
Dry	34	224	45.12	49.27	9.49	8.42	28.55	14.65	9.93	34.78	13.2	246
Brine	67	224	46.91	52.46	11.42	10.58	26.78	12.87	7.87	29.54	24.6	223

[1] The apparent losses of thiamine were calculated from the values expressed as micrograms of thiamine per 1 gm. of protein.

moisture in the lean meat was several points higher than when calculated in the usual manner. However, in no case was the moisture content of the cured ham (salt-free basis) higher than that of the fresh ham.

The salt content of the hams at the end of the curing in experiment No. 1 ranged from 4.28 percent in the dry-cured hams to 6.01 percent in the brine-cured hams. After storage for 224 days, the salt content increased to 6.41 percent in the dry-cured hams and to 9.83 percent in the brine-cured hams. In experiment No. 2 the salt content of the cured hams ranged from 5.51 percent in the dry-cured hams to 6.93 percent in the brine-cured hams. After storage for 224 days the range was from 8.42 percent in the dry-cured hams to 10.58 percent in the brine-cured hams.

The protein content of the artery-cured hams in each experiment was appreciably lower and that of the dry-cured hams was moderately higher than that of the fresh hams. As a result of storage for 112 days there was a considerable increase in the protein content of each lot of hams, followed by smaller increases during a further storage period of 112 days. The total increases in protein during curing and storage ranged from 4.8 to 9.5 percent in experiment No. 1 and from 4.0 to 8.6 percent in experiment No. 2. The greatest increase took place in the dry-cured hams. The increases in the percentages of protein in the hams while in cure and storage were due, of course, to losses of moisture from the meat.

Since lean fresh pork is an excellent source of thiamine, the changes that took place in the thiamine content of the hams during the curing and storage periods are of particular interest. The results of experiment No. 1 indicate apparent losses ranging from 20.8 to 43.4 percent while in cure, followed by some smaller additional losses during subsequent storage. The greatest losses of thiamine were from the brine-cured hams. In experiment No. 2, the apparent losses of thiamine during cure were relatively small, followed by larger losses during storage. The average losses of thiamine in the two experiments were as follows: (1) At the end of curing: artery 15, dry 14, and brine 26 percent; (2) After storage for 224 days: artery 21, dry 26, and brine 32 percent. These results may be compared with those of Schweigert *et al. (6)* who reported recovery of 85 percent of the thiamine in hams cured by injection followed by immersion in brine. Jackson *et al. (5)* reported recovery of 74 percent of the thiamine in wet-cured sides.

The fuel value of the artery-cured hams was slightly lower at the end of the curing period in each experiment than that of the fresh hams, whereas the values for the brine- and dry-cured hams were somewhat higher. During storage there was a marked increase in the fuel value of each lot of hams associated with the loss in moisture.

BIOLOGICAL VALUE AND DIGESTIBILITY OF PROTEIN

In Table 5 are shown the results of feeding tests with young male albino rats to determine the biological or growth-promoting value and the digestibility of the protein in cured, smoked hams as compared with the protein in fresh hams. The term "biological value" denotes the average gain in weight of 8 male albino rats in 30 days for each gram of nitrogen consumed.

In experiment No. 1 the results indicate no material differences between the biological value of the protein in any lot of cured hams, even after storage for 224 days at 68° F., and the value of the protein in fresh ham.

The protein in each lot of hams at the end of the curing period in experiment No. 1, as well as the protein in fresh hams, was found to be practically 100 percent digestible. Further digestion tests were considered unnecessary.

In experiment No. 2, the results also indicate no material differences between the biological values of the protein in cured hams, even after storage for several

months, and the values for fresh hams. In general, the results of these experiments indicate that the protein in hams cured by any one of the three methods was as high in nutritive value as the protein in fresh hams.

SUPPLEMENTAL VALUE OF CYSTINE AND METHIONINE FOR PORK PROTEIN

In Table 6 are shown the results of feeding tests with rats to determine whether the protein in fresh or cured ham was deficient in cystine or methionine when the diets contained 10 percent of protein (1.6 percent of nitrogen). In the first section of Table 6 are shown the results when fresh and cured hams were the only sources

TABLE 5

Average biological values and digestibility of protein in fresh and cured hams when fed to groups of 8 male rats for 30 days

Description of hams	Curing period	Storage period	Gain in weight		Feed consumed	Gain in weight per gram of nitrogen consumed		True digestibility
			Average	Range		Average	Range	
	Days	*Days*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Percent*
Experiment No. 1								
Fresh No. 4296			102	85-116	306	20.91	19.5 -21.96	100
Artery cured	15		105	85-128	315	20.71	18.32-23.03	100
Dry cured	37		114	93-133	337	21.01	19.93-22.68	100
Brine cured	71		106	76-126	320	20.63	18.4 -22.18	99.1
Fresh No. 4296			96	85-115	297	20.06	18.66-23.28	
Artery cured	15	112	108	85-130	331	20.25	17.89-22.81	
Dry cured	37	112	106	94-116	334	19.78	18.73-21.36	
Brine cured	71	112	106	89-119	323	20.35	18.13-21.89	
Fresh No. 4296			104	89-120	316	20.50	19.37-22.85	
Artery cured	15	224	112	101-127	330	21.16	19.20-24-14	
Dry cured	37	224	105	91-135	331	19.77	17.55-21.99	
Brine cured	71	224	114	101-128	343	20.77	19.13-22.74	
Experiment No. 2								
Fresh No. 4361			105	89-117	316	20.72	18.94-22.72	
Artery cured	15		120	109-133	346	21.68	20.46-23.62	
Dry cured	34		110	89-125	319	21.47	19.52-23.37	
Brine cured	67		109	85-138	322	21.06	18.09-23.63	
Fresh No. 4361			107	90-114	324	20.60	19.62-21.33	
Artery cured	15	112	108	94-125	334	21.42	19.14-22.32	
Dry cured	34	112	103	81-124	320	19.98	18.72-21.6	
Brine cured	67	112	115	101-127	346	20.68	18.67-21.97	
Fresh No. 4361			93	80-113	304	18.97	17.66-20.58	
Artery cured	15	224	107	89-126	325	20.48	18.64-22.38	
Dry cured	34	224	101	80-126	316	19.94	18.31-20.85	
Brine cured	67	224	107	96-123	329	20.38	19.14-22.36	

of protein in the diets. In the second section are shown the results when each diet was supplemented with 0.2 percent cystine. The data indicate clearly that the growth-promoting value of the protein in each lot of cured ham, as well as the protein in fresh ham, was very definitely increased by the addition of cystine to the diet.

In the third section of Table 6 are shown the results when a composite sample of hams cured by the three methods was supplemented with cystine, methionine, and with methionine and tryptophane. The data indicate very highly significant increases in biological values when the ham was supplemented with cystine and

somewhat larger increases when like quantities of methionine were added. The addition of both methionine and tryptophane yielded poorer results than methionine alone. The reason for this anomalous result is not apparent.

A statistical analysis was made of the data from which the biological or growth-promoting values of the protein in section 3 of Table 6 were derived. Tests by

TABLE 6

Average supplemental value of cystine and methionine for the protein in fresh and cured hams when fed to groups of 8 male rats for 30 days

Nitrogen in diet			Gain in weight		Feed consumed	Gain in weight per gram of nitrogen consumed	
Source	Diet No.	Percent	Average	Range		Average	Range
			Grams	*Grams*	*Grams*	*Grams*	*Grams*
Fresh ham No. 4361	1	1.60	105	89-117	316	20.72	18.94-22.72
Artery-cured ham No. 4375	2	1.60	120	109-133	346	21.68	20.46-23.62
Dry-cured ham No. 4382	3	1.60	110	89-125	319	21.47	19.52-23.37
Brine-cured ham No. 4396	4	1.60	109	85-138	322	21.06	18.09-23.63
Average			111		326	21.23	
Fresh ham No. 4361 + 0.2 percent cystine	5	1.62	128	104-140	328	24.13	22.88-25.61
Artery-cured ham No. 4375 + 0.2 percent cystine	6	1.62	136	102-150	343	24.47	21.84-25.42
Dry-cured ham No. 4382 + 0.2 percent cystine	7	1.62	132	115-155	342	23.80	22.50-25.45
Brine-cured ham No. 4396 + 0.2 percent cystine	8	1.62	138	127-149	348	24.43	22.87-26.34
Average			134		340	24.21	
Cured ham No. 4438	9	1.60	109	101-127	331	20.64	19.54-22.13
Cured ham No. 4438 + 0.2 percent cystine	10	1.62	129	114-143	342	23.29	21.99-25.22
Cured ham No. 4438 + 0.4 percent cystine	11	1.65	126	110-141	324	23.57	22.41-24.77
Cured ham No. 4438 + 0.2 percent methionine	12	1.62	135	120-166	341	24.50	23.35-25.91
Cured ham No. 4438 + 0.4 percent methionine	13	1.64	133	124-140	328	24.77	23.73-25.38
Cured ham No. 4438 + 0.4 percent methionine + 0.1 percent tryptophane	14	1.65	117	104-130	306	23.22	22.24-24.70

means of Fisher's "t" values for the significances of differences between the means of the gain in weight per gram of nitrogen consumed showed the following probability values:

Diet 9 with diets 10, 11, 12, 13, and 14—very highly significant. ($< .001$)
Diet 14 with diet 13—very highly significant. ($< .001$)
Diet 13 with diets 10 and 11—highly significant. ($< .01$)
Diet 12 with diet 14—highly significant. ($< .01$)
Diet 12 with diets 10 and 11—significant. ($< .05$)
Differences between all other diets—not significant.

CHANGES IN FAT

In Table 7 are shown changes that took place in the fat of the hams during the curing process and in subsequent storage. The results indicate moderate increases in free fat acids during the curing process and much larger increases during the storage of the cured hams. Only three samples of fat reacted with the Kreis test for rancidity.

TABLE 7

Changes in fat of hams during cure and storage

Description of fat	Method of cure	Time in cure	Time in storage	Free fat acids	Kreis test
		Days	*Days*	*Percent*	
Experiment No. 1					
External	Not cured	0	0	0.02	Negative
Intramuscular	Not cured	0	0	0.82	Negative
External	Artery	15	0	0.56	Negative
Intramuscular	Artery	15	0	1.72	Negative
External	Artery	15	112	5.28	Negative
Intramuscular	Artery	15	112	4.61	Negative
External	Artery	15	224	8.80	Negative
Intramuscular	Artery	15	224	10.26	Negative
External	Dry	37	0	0.83	Negative
Intramuscular	Dry	37	0	1.99	Negative
External	Dry	37	112	4.03	Negative
Intramuscular	Dry	37	112	3.66	Negative
External	Dry	37	224	7.07	Very slight
Intramuscular	Dry	37	224	7.75	Negative
External	Brine	71	0	1.20	Negative
Intramuscular	Brine	71	0	2.34	Negative
External	Brine	71	112	6.71	Negative
Intramuscular	Brine	71	112	4.99	Negative
External	Brine	71	224	11.21	Negative
Intramuscular	Brine	71	224	11.50	Negative
Experiment No. 2					
Intramuscular	Not cured	0	0	0.68	Negative
Intramuscular	Artery	15	0	1.80	Negative
Intramuscular	Artery	15	112	8.55	Negative
Intramuscular	Artery	15	224	10.40	Negative
Intramuscular	Dry	34	0	2.19	Negative
Intramuscular	Dry	34	112	4.83	Negative
Intramuscular	Dry	34	224	9.16	Slight
Intramuscular	Brine	67	0	1.95	Negative
Intramuscular	Brine	67	112	7.43	Slight
Intramuscular	Brine	67	224	7.31	Fair

GROWTH-PROMOTING VALUE OF FAT

In Table 8 are shown the results of feeding tests with young rats to determine the effects of rendered external fat from cured hams on growth as compared with the fat from fresh hams. The results indicate that the rats fed from each of the three lots of smoked, unstored ham made practically as rapid and as efficient growth as those fed fat from fresh hams. When rats were fed fat from hams that had been stored for 224 days, those receiving the artery-cured and dry-cured material made as satisfactory growth as those fed fat from fresh hams. The results with the fat from the brine-cured hams were somewhat less favorable, the difference being barely significant. Reference to Table 7 shows that the fat from the cured hams after storage for 224 days contained the following percentages of free-fat acids: artery cure, 8.80; dry cure, 7.07; and brine cure, 11.21.

A statistical analysis was made of the data from which the growth-promoting values of the fats (gain in weight per 100 calories) in section 2 of Table 8 were derived. The results indicate the following probability values:

Diet 5 with diet 8—significant. ($< .05$)
Differences between other diets—not signifiant.

TABLE 8

Average growth-promoting values of diets containing 15 percent each of external fat from fresh and cured hams when fed to groups of 8 male rats for 30 days

Diet No.	Description of hams			Gain and intake in 30 days				
	Method of cure	Curing period	Storage period	Gain in weight		Feed consumed	Gain in weight per 100 calories	
				Average	Range		Average	Range
		Days	*Days*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*
1	Not cured	0	0	150	141-167	375	9.73	8.92-10.23
2	Artery	15	0	141	115-156	351	9.79	8.96-10.09
3	Dry	37	0	144	110-173	358	9.68	8.49-10.42
4	Brine	71	0	143	119-174	364	9.56	8.87- 9.96
5	Not cured	0	0	145	119-170	355	9.96	9.32-10.77
6	Artery	15	224	144	108-177	361	9.70	8.47-10.40
7	Dry	37	224	141	122-174	347	9.88	9.26-10.88
8	Brine	71	224	130	105-146	335	9.41	8.71-10.27

SUMMARY

Experiments were conducted with the hams from 42 hogs weighing approximately 225 pounds each. All hogs were full-fed rations consisting basically of corn or wheat, supplemented with protein concentrates and minerals. The purpose of the study was to determine the effects of different methods of curing on the composition and nutritive value of hams.

One method of curing involved artery-injection of brine followed by immersion therein. The other methods involved the application of the curing igredients as a dry mixture in one instance and immersion of the hams in brine without previous injection in the other instance. All cured hams were subsequently smoked about 15 hours at a smokehouse temperature of approximately 115° F. (46° C.). As a basis for calculating gains and losses in processing and storage, hams were weighed (1) in the fresh state, and after (2) curing, (3) smoking, (4) 112 days in storage at 68° F. (20° C.) and (5) 224 days in storage at 68° F. (20° C.).

Artery-cured hams increased 11 to 12 percent in weight due to injection and about 4 percent more as a result of immersion. Dry-cured hams lost weight in cure and the brine-cured hams gained about 6 percent. Based on fresh weight, artery-cured hams as smoked product showed an average gain of approximately 6 percent, dry-cured hams a loss of 9 percent, and brine-cured hams a loss of somewhat more than 3 percent. After 224 days' storage, all showed definite losses, averaging about 17, 24, and 23 percent, respectively.

The actual losses of protein in the pickle from the hams during the curing process were relatively small. The average percentage losses of total crude protein ranged from 1.35 for dry-cured hams to 5.19 for brine-cured hams. The losses of coagulable or true protein were only about one-fourth as great.

The actual moisture content of the lean meat of the smoked hams was lower for those cured by each method than that of the fresh hams. The difference was least for the artery-cured and greatest for the dry-cured hams.

The protein content of the lean meat of the artery-cured hams was appreciably lower at the end of the curing period than that of the fresh hams, whereas the protein content of the brine-cured hams was slightly higher, and that of the dry-cured hams was considerably higher.

The energy value of the lean meat of the artery-cured hams was slightly lower than that of the fresh hams, whereas the values for the brine-cured and dry-cured hams were appreciably higher.

The thiamine content of the hams decreased appreciably during the curing process, the apparent average percentage losses being as follows: artery-cured, 15, dry-cured, 14, and brine-cured, 26. The average percentage losses of thiamine after the hams had been stored 224 days were as follows: artery-cured, 21; dry-cured, 26; and brine-cured, 32 percent.

During storage of the cured hams for 224 days there was a marked reduction in the moisture content of the lean meat with a corresponding increase in the other constituents, except thiamine.

The biological or growth-promoting value and the digestibility of the protein in the hams cured by the artery, dry, and brine methods were fully equal to the values obtained for fresh hams. Storage of the cured hams for 224 days was without material effect on the nutritive value of the protein.

The biological values of the protein in both fresh and cured hams were considerably enhanced by the addition of either cystine or methionine to diets containing 10 percent of protein.

The free fat acids in cured hams increased very considerably during storage for 224 days. The increases for the external fat were as follows: artery-cured hams from 0.56 to 8.80 percent; dry-cured hams from 0.83 to 7.07 percent, and brine-cured hams from 1.20 to 11.21 percent.

The growth-promoting value of the rendered fat from the hams cured by each method was fully equal to that of the fat from fresh hams. The fat from hams stored 224 days, with the possible exception of that from brine-cured hams, induced as good growth as the fat from fresh hams.

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RECENT JAPANESE RESEARCHES ON CANNING TECHNOLOGY

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(REVIEW PAPER)

Japanese literature, published immediately before World War II is reviewed, covering the following subjects: (1) sterilization and cooling of cans, (2) measuring vacuum in cans, and (3) resistance of cans to double seaming.

The *Bulletin of the Japanese Society of Scientific Fisheries* published just before World War II some highly interesting papers on various phases of canning technology. These, unfortunately, are printed in Japanese and are therefore practically inaccessible to American readers. It is the purpose of this note to describe the significant results of a few articles which have come to the writer's attention.

The subject of the cooling of cans in air and in water has received consideration in two papers by Okada *(3, 4)*. It has been customary in American practice to disregard the effect of film conductance on the outside of the can. For the most part, this has been justified since when heating or cooling objects of low thermal diffusivity in an atmosphere of steam, film conductance plays a negligible part. Unfortunately, the long neglect of the concept of film conductance has created a state of mind which is loath to give it the place it deserves in our technology. The study of the cooling of cans in air, however, forces one to pay attention to film conductance. The derivations given by Okada are too lengthy to be given here, but his final experimental results are of interest. They are given in Table 1.

TABLE 1

Values of the Film Transfer Coefficient h

Can length cm	Can radius cm	h for air cooling cal/cm² sec °C	h for water cooling cal/cm² sec °C
10.75	3.70	2.6×10^{-5}	2.3×10^{-4}
10.75	4.18	2.7×10^{-5}	6.3×10^{-4}
3.95	4.18	7.5×10^{-5}	5.2×10^{-4}

These results are to be considered approximate and should indicate not much more than the order of magnitude of the effect. The approximation arises not only from the experimental inaccuracies but also in the assumption in the derivation that the product of the heat capacity and the density is equal to unity. This makes the thermal conductivity numerically equal to the thermal diffusivity. For food products, this assumption seems not unreasonable.

Products which heat purely by convection have been studied by Okada *(2)* and his student Kaneko *(1)*. Okada's treatment is by dimensional analysis in conjunction with the differential equations of motion and heating. Here too, the derivations are too lengthy and difficult to give, but his final results are that the temperatures in the can are given by equations of the form

$$T/T_o = F(x/l, y/l, z/l, at/l^2, Nu, Gr, Pr)$$

where T is the temperature at some point in the can given by the coordinates x, y, z, and at time t

T_o is the initial temperature of the can
l is some "representative" dimension as length or diameter
a is the thermal diffusivity
Nu is the Nusselt number
Gr is the Grasshoff number
Pr is the Prandtl number.

This result, while not surprising, is of considerable theoretical significance and should yield practical results if pursued farther.

A paper by Kaneko *(1)* presents several puzzling features, particularly since it was written under Okada's supervision. The summary in English reads: "The time, *f*, required for the difference in temperature between the centre of canned foods and medium during sterilization to diminish to a tenth of its value is not directly proportional to the ratio of the volume to the surface area of the cans, as so was recently pointed out by O. T. Schultz and F. C. W. Olson *(5)*, but is practically proportional to the square of the same ratio." Kaneko then correctly gives the derivation of the equations of Schultz and Olson. He then proceeds afresh, using results from *conduction* theory, to derive the result that *f* is more nearly proportional to the square of the ratio of the volume to the surface area of the can. His conclusion is supported by experimental results, which also add to the confusion. For instance, for a 603 x 408 can, $f = 120$, and for a 401 x 201 can, $f = 48$. This clearly indicates that the test products heat by conduction alone. Kaneko's result is interesting, and, for conduction heating, quite valid. It is a valuable, even if not a profound contribution to canning technology. The surprising thing is that both Kaneko and Okada apparently overlooked the title of the paper by Schultz and Olson *(5)*, which clearly indicated that the discussion concerned *convection* heating. An oversight of this magnitude must be due to a severe language difficulty. It presents a strong argument for the international use of Esperanto for scientific publications.

A series of papers by Tomimasu *(6, 7, 8, 9, 10)* on "Measuring of the Vacuity of Full Cans by the Elastic Deflection of their Upper and Lower End Plates" describes various experiments on, and equipment for, measuring can vacua by deflection of the ends. The first paper *(6)* reports the interesting observation that even in a high vacuum can, there is no observable creep of the metal in the can end over a three month period. Tomimasu's tests were on a fairly large scale and seemed to be carefully executed. The other papers are not of general interest, but do have fairly complete English summaries.

The *Transactions of the Society of Mechanical Engineers, Tokio* contains a masterly paper by Tomimasu *(11)* on "Seaming Resistance of Tin Plate Cans." This contains an extensive mathematical analysis of the forces involved in making the first operation in double seaming plus a report on an elegant experimental method of measuring these forces. The mathematical analysis is sufficient to arouse admiration, but the experimental part will make most Americans envious of the fine equipment which was available to the Japanese for a research project such as this. The pressures occurring during seaming were measured by inserting quartz blocks in the rod pressing the first operation roll against the seam. The piezo-electricity generated in the quartz blocks during seaming was measured by a string electrometer and the deflection of the string was photographed by a sliding camera. Altho the first operation roll was in contact with the double seam for a period of less than one second, with this equipment the pressures were accurately and continuously recorded in graphical form.

In conclusion, it may be stated that before World War II the Japanese were: (1) making a serious effort in applying the scientific method to canning technology; (2) they were well supplied with fine modern equipment; (3) they had investigators of high scientific standing.

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NEW TECHNICS IN COMMERCIAL PRESERVATION OF FISH AND FISHERY PRODUCTS [a]

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(REVIEW PAPER)

New labor saving equipment as well as new fishery products are discussed. War time limitations in the machinery and fishery industries are now over, so new technics and development are to be anticipated.

Filleting machines as well as scaling and skinning equipment make attainable volumes of product which contribute to an overall economy for these foods.

Improvements in salting, smoking, and shredding as well as improvements in canned fish technology will increase the markets for these fishery products.

"New" varieties of fish and specialty items, together with the increasing rise of refrigeration are present day developments.

INTRODUCTION

This paper is limited to a discussion of some of the newer developments in the commercial handling and preservation of fish and fishery products. No attempt is made to include all new or novel methods, and no information is included that has been revealed in confidence.

The number of new technics has been limited by the post-war shortage of raw materials for fabricating equipment, and the acute labor shortages that beset both the machinery and the fishing industries until recently. Any discussion of new technics is usually limited to a description of so-called labor saving machinery. Hand labor replacement is usually very attractive to management in periods of tight labor supply. This trend is equally unattractive to labor in periods of even minor employment. We take a neutral view, and wish to emphasize that mention of any new technics does not necessarily imply wholehearted recommendation. Management and labor will have to consider both the short and long range effects of their practices on the economics of production and distribution, human engineering, and social responsibility.

It is a fundamental fact that greater consumption of fish and fishery products is contingent on the availability of these items to the homemaker in a form which reduces pre-cooking handling to a minimum and which permits serving an appetizing dish of pleasing appearance. The fishing industry has, therefore, shown considerable interest in methods for preparing fillets for sale as fresh chilled, or quick frozen. Industry has also explored the possibilities of preparing specialty raw or pre-cooked frozen products; superior salted, smoked or pickled specialty items, and a wider variety of canned products.

In the future, price commodities may become an increasingly important consideration with the homemaker. Consumer acceptance must be carefully analyzed to estimate factors affecting market demand.

FISH FILLETS

In some filleting plants mechanization is used to a considerable extent. Several types of mechanical scalers are now in use which reduce the manual handling of fish to a minimum. Of course, the fish need not be scaled if skinned fillets are to be produced.

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One is a cage-like, tumbler scaler which consists essentially of a horizontal rotary cylinder having a wall of stainless-steel, expanded metal lath. The cut edges of the twisted metal in the lath are rough, and have an abrasive action which removed the scales from the fish tumbled in the scaler. Interior baffles turn the fish so scaling is complete. The cylinder is framed on a hollow axle shaft fitted with perforations. This permits pumping a water spray at high pressure into the interior of the cylinder which washes away the scales, and cleans the fish. The incline of the cylinder is adjustable and determines the speed of passage of fish. Fish difficult to scale are held in the machine for a longer period than those which are more easily scaled.

A second type of scaler consists of an endless metal conveyor which passes around a vertical rectangle. The fish to be scaled are clamped to the conveyor by their tail fins. First one side of the fish and then the other is carried across the face of revolving stiff brushes which remove the scales.

Several recent installations of filleting tables have included conveyor belts to handle the fish and fillers so manual handling has been practically eliminated. The raw material is brought to the filleters on a belt conveyor at table top level. The filleters stand along both sides of the table. A second belt conveyor about a foot higher than the first carries the cut fillets to the packers, and a third conveyor placed several feet under the first, removes the offal to a disposal tank. Portable chutes connect a hole in the surface of the filleting table with the lower belt conveyor, and this permits keeping the table clean with a minimum of effort. The design of this unit permits easy cleaning so good sanitation is assured.

The first machine filleter was not developed and used commercially until 1943, although commercial filleting of fish in the United States was first started in 1921 here in Boston. A successful machine had to meet exacting requirements. The raw material varies considerably in size and texture. The machine had to operate within very narrow limits, and yet be sturdy and readily adjustable. Oil and grease can not be used in exposed friction surfaces. The foregoing lists only a few of the problems which had to be overcome in the development of the machine.

Time does not permit a detailed description of the several machines now in operation. Mention will be made of the method of cutting fillets by the Hunt machine, as an example. The headless scaled fish are fed, back down and tail forward, into the machine at a rate of about 45 per minute. Grippers hold the fish and bring them into exact alignment with the cutters. Four sets of cutters are used in the filleting operation. The first is a pair of circular cutting knives with parallel scrolled surfaces for making incisions along the back. This permits removal of the dorsal fin leaving a groove in the back. The second is a pair of stationary plow knives which make parallel cuts along the back towards the rib bones. A pair of traction discs than grabs the tail of the fish and pulls it forward against the third set of knives, namely, a set of belly-cutting knives. These cut on each side of the belly fin towards the back bone.

The fillets adhere to the skeleton by a thin strip of flesh along each side of the backbone and by a band of flesh along the upper part of the ribs. The fourth set of paired ribbing knives extend from the traction discs to the discharge end of the machine, and these sever the remaining attachments so two fillets are produced. The fillets fall on conveyor belts located under the ribbing knives and the skeleton falls between the ribbing knives to an offal conveyor beneath. The fillets are well cut, and the yield is satisfactory.

Fillets are sold both with skins and skinless. At the present time there does not seem to be any rule of preference. In some instances it is believed that an increased quantity of skinless fillets can be sold so skinning fillets is practiced. In other cases

it is easier to skin a fillet than to scale and clean the fish. At least one skinning machine for fillets is used commercially.

With the Jensen machine, the fillets are laid skin side down on an endless belt. The fillets are held flat to the belt by a second very light weight belt, pressed against the fillets by a series of rings hung loosely from an overhead support. The fillets are carried against a band saw type of knife which operates crosswise to the direction of the carrier belt. The thickness of skin removed can be closely adjusted by the distance from the knife to the upper surface of the carrier belt. Almost tissue paper thin cuts can be made if necessary.

Several companies are packaging fresh fillets in consumer sized packages, but this is the exception rather than the rule. One firm has introduced assembly line methods in packaging fish fillets. Fillets are placed according to fixed weights into metal molds which are open on top and at one end. The filled molds are placed at an angle in racks on a revolving table. A moisture-vaporproof bag is slipped over the mold containing the fillets by an operator who is seated at the rim of the table. The mold is removed, the bag containing the fish is fitted into an outer carton, and the carton is closed, overwrapped and heat sealed by other operators seated adjacent to the first.

The only really new developments in quick freezing fish and also crab meat are the combined fishing and processing vessels on the Pacific Coast. These combination trawlers are fitted with equipment and freezing facilities so fishery products can be processed on board. One mother ship of about 8,000 tons has been fitted for quick freezing and canning crabs and fish. The products are frozen either in the round or in packages, depending on the species caught and anticipated demand. These vessels have not yet been in operation for a long enough period to determine the comparative costs of processing at sea and in shore plants.

A number of new packing materials have been made available during the past few years despite the limited raw material supply. These include metal foils, combination fibre and metal packages, and the better known moisture-vaporproof wrappings. Most companies are still experimenting with different sizes of packages and with different packaging materials in order to determine factors affecting the sale of frozen fishery products. A good deal of frozen fish is still being thawed and sold as fresh chilled by many retailers.

SPECIALTY PRODUCTS

A number of specialty products have appeared on the market recently. These include pre-cooked frozen dishes such as shrimp creole, fish a la king, etc. At least one company is offering packaged pre-cooked frozen meals of which several menu items are fishery products.

Incidentally, one of the drawbacks to retailing cooked shrimp, either chilled or quick frozen, has been the problem of removal of the sand vein. It was a slow and costly process when done by hand. Recently a machine was perfected which removes the vein from either raw shelled shrimp, or raw shrimp in the shell.

The essential working parts of the machine are a "V" shaped feed belt which carries the shrimp with their backs down over a circular knife. Over the knife is an adjustable counter balanced wheel which presses the shrimp against the knife so a cut is made to the desired depth. A high pressure water spray washes the cut as soon as it is made, and the cleaned shrimp are flumed to the packaging table. A single unit is said to be able to remove the sand vein from about 160 pounds of shrimp an hour.

SALTED, SMOKED AND PICKLED ITEMS

The most important improvement in producing salted fish is through drying by mechanical means. One type of dryer has been developed essentially for drying shredded salt cod. It is a tunnel type of dryer for continuous operation. The shredded fish is carried to the upper section of the dryer by means of a screw conveyor. The fish then falls on a horizontal, stainless steel wire screen belt conveyor. Two paddle wheels are placed so as to spread the fish uniformly over the surface of the belt. The shredded cod passes under a battery of infra-red lamps which heats the flesh to about 150° F. Air is blown through the fish from ducts below the conveyor. This drives off the moisture, and prevents over-heating. The fish than falls to a belt at a lower level and the process is repeated. The shredded fish is finally cooled under a battery of fans, and is then carried to the packaging table. This dryer has a capacity of 4000 to 4300 pounds per 7½ hour operating day.

A second type of dryer for salt fish was developed in Canada. Ordinarily, salt cod has been found to scald, case-harden, or become brittle very quickly when mechanical drying was attempted. It was found that satisfactory batch drying could be accomplished if the air temperature was maintained at 75° F., the velocity of air at 200 to 300 feet per minute and the humidity at 40 to 50 percent. The commercial dryer consists of a tunnel or rotating turret fitted with several shelves or bars on which fish are stacked in trays or on portable trucks. Unwarmed air, if the outside temperature is satisfactory or heated air is forced through the tunnel or turret by a fan. A variable volume of air is recirculated by means of a return air duct. It may be necessary to dehumidify part of the air by means of refrigeration if the outside air contains too much moisture.

These dryers have been built in different sizes and they may have a batch capacity as high as 90,000 pounds of green salt cod. The cod dried in these plants have a better color and texture than the average commercially available product.

There has also been an improvement of smoked fishery products due to better control of the temperature and volume of circulating air in the smokehouse, and the density and temperature of the smoke. In Canada, tunnel smokehouses somewhat similar in construction to the previously described tunnel dryers have been used to advantage. In this country, specially designed smoke producing equipment has been available commercially to the meat packing and fishery industries. Some very neat and efficient smokehouses have been inspected by the authors which have incorporated standard monorail, or truck equipment, ventilating apparatus, and commercially available smoke producers in their construction. The principal new feature in pickled fishery products is the greatly expanded production of pickled fillets of herring packed in glass. These are very popular.

CANNED FISHERY PRODUCTS

The canning industry has been handicapped by a lack of tin plate and steel since the early days of the war, and by material shortages for producing new equipment. Many "new" varieties of fish were packed in small quantities, and they had some sale when meat supplies were short and no canned salmon or tuna, and few sardines and pilchards were available. Their continued acceptance in the future is problematical. Some specialty products such as canned shad roe, smoked salmon, shad, oysters, etc. may have an expanded market as more people become better acquainted with their merits.

One of the new developments in the production of canned fishery products is the increased use of refrigeration to store fish prior to canning. This is particularly true for the albacore tuna fishery of the Pacific Northwest.

Grated tuna production was greatly expanded during the war due to the scarcity of labor to pack solid meat. Trimmed loins are grated mechanically and the grated material is conveyed to the reservoir of a filler. A measured quantity of fish is delivered mechanically to a compression compartment, and is then forced into the can.

One machine has been developed for packing solid meat into cans. This machine is very complicated. Pieces of tuna loin which have been cut to right lengths by an improved guillotine knife are selected by a delicate weighing device. Three pieces are selected which total the exact weight to be placed in the can. These pieces are automatically placed in a compression cylinder which fits them to the area of the can. A piston then forces the compressed cylinder of fish into the can and the cans are conveyed to the next step in the process. This machine operates within very narrow weight tolerances and shows good workmanship in filling cans.

In the salmon industry, combination fish cutter and filling machines have now been developed for high speed operation. Formerly two machines were needed.

In conclusion, it is to be expected that many new developments can be disclosed in the next few years when equipment and supplies should become more plentiful. The fishing industry is resourceful and will exploit all available opportunities to expand the consumption of the many appetizing fishery products available in this country.

SANITATION TECHNIC IN THE FROZEN FOOD INDUSTRY[a]

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(REVIEW PAPER)

This article is a concise review of sanitary practices and standards that are essential in frozen food plants. It covers steps from arrival of raw materials to disposal of waste.

Sanitary maintenance is a great responsibility placed upon the frozen food processor. It is necessary for management to recognize good sanitary technique. If the industry intends to increase consumer acceptance of high-quality merchandise, every step in the selection and processing of food in the frozen food plant, as well as the habits of the individual food handler, the use of a proper food container, and the conditions of the ultimate trip to the consumer should be under sanitary control. Foods are subject to seizure by due process of law when shipped in interstate commerce if adulterated as defined in the Food, Drug and Cosmetics act of 1938. Sanitary technique has been developed to aid the industry, and one would expect to find food prepared, packed, and held under sanitary conditions; however, some of these methods have not been put into practice. A basic problem is to distinguish between untidy and disorderly housekeeping in a food plant and to recognize those conditions which contribute directly to inferior quality such as freezing over-ripe foods, the presence of foreign matter, and prolonged holding of raw food resulting in excessive growth of bacteria, yeasts, and molds.

A food freezing plant should be maintained in a sanitary condition at all times. In evaluating the sanitary conditions of a food freezing plant, we would consider the location of the building and the building itself, the operating conditions of the actual work rooms, the source and sanitary conditions of the water supply, the appearance of the equipment, the methods used for cleaning and sterilizing the equipment, the manner of handling and storing the raw food product, the manner of disposal of waste and the personal appearance of the workers. The importance of some of these items is at once apparent; others will be found to be just as important in sanitary significance.

The building used for freezing food should be used for no other purpose and it should be located in an environment free of refuse, garbage, and other nuisances. It should be of sufficient size to permit easy access to all pieces and parts of equipment.

The floors should be smooth, impervious to organic matter, sloped one-half inch per foot to properly (bell) trapped drains and flushed daily with a germicidal solution of hypochlorite with 100 p.p.m. residual Cl or a quaternary ammonium compound in a 1:500 dilution.

The walls and ceiling should be clean and easily washed. Whitewashing is acceptable in storage or warehouse areas because slaked lime is both a germicide and an insecticide. The window space should be in excess of ten percent of the floor area to afford adequate natural light. Artificial lighting should exceed ten foot-candles of intensity in order to facilitate the reading of equipment gauges and prevent accidents. All openings should be screened with 16-mesh screen, or forced air-draughts can be used to prevent the entrance of flies. The actual work room for the sorting, washing, cutting, blanching, and freezing operations should be separate from the delivery and storage centers. It should be cleaned regularly with chlorine solutions of not less than 100 p.p.m. of residual chlorine.

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[a] Presented before the Seventh Annual Food Conference, Boston, Mass., June 4, 1947.

A water supply meeting the sanitary requirements of drinking water having less than 50 bacteria per cc. and less than 2 *E. coli* in 100 cc., must be available in quantity and made easily accessible to all parts of the plant. Dual water supplies are not recommended but if water is available from a well meeting the physical standards of color, turbidity and the above sanitary standard, it can be used. All cross-connections between clean water and waste water must be avoided. A water pressure of 40 to 50 p.s.i. should be adequate for flushing purposes. Sewer drains should be large enough (a minimum of 8 inches) to quickly carry off all wash and waste water, and should be provided with cleanout places to prevent clogging. Screening of the sewage may be necessary before it is discharged into a sewer line or a stream. Toilets and washroom fixtures should be so constructed and operated as to prevent back-siphoning into the water system. Adequate lavatory facilities are indispensable for personal cleanliness of the foodhandlers. Soap, hot water (135° F.) and individual towels should be supplied.

Crates, hampers, lug boxes, and containers should be washed clean with a 2 percent tri-sodium phosphate solution or steamed and then treated with a dilute (1:500) germicide such as the quaternary ammonium compounds or chlorine solutions (1:200 p.p.m. residual chlorine). Wherever possible, manual contact with food should be avoided. All utensils such as paring knives, ladles, dippers, pans, and pails should be cleaned with a good detergent and rinsed in a hypochlorite solution. Rubber inspection-belts, metal conveyors, blanchers, quality graders, cleaning reels, rotary washers, and fillers should be cleaned at the end of each day's run, before operation, and at each "shutdown" period with sodium carbonate, tri-sodium phosphate or sodium metasilicate, and then flushed free of the detergent. The above cleaning should be followed with either a chlorine solution (200 p.p.m.) made from hypochlorite or liquid chlorine, or a solution (1:500) of a quaternary ammonium compound. Conveniently located wash-tanks large enough to hold 8-foot sanitary piping lengths and smaller pieces of equipment are needed for soaking and should be made available. Rinse waters should be chlorinated or treated with a 1:500 dilution of any other non-toxic, effective germicide, and maintained at a temperature below 70° F.

The plant layout should be such that the opportunities for contamination are reduced to a minimum by use of a straight line assembly. Spoiled and over-ripe food should be removed from sorting tables at frequent intervals and placed in waste cans. Sugar and salt should be stored in a clean dry place, protected from vermin and dust. Shelves or racks should be 6 inches off the floor to facilitate cleaning.

The hand-washing of utensils with soap and water calls for a soap concentration of 0.1 to 0.3 percent and a temperature of about 120° F. The machine-washing of utensils calls for a detergent in two to four percent concentration and a temperature of about 135° F. Both methods of washing should be followed by a rinse with hot (185° F.) water. Caustic soda (sodium hydroxide) in a 4 percent concentration yields a pH value of 13.2. It should be noted that steaming alone is of questionable value for cleansing because of the condensation of steam on cold surfaces, and the baking on of debris.

All raw food should be protected from contamination, spread out on shallow lugs to prevent heating, and if necessary, refrigerated at 40° F. to retard the growth of bacteria, yeasts, and molds. Frozen corn showed 44,000 colonies per gram as delivered to the consumer in Philadelphia in May of this year. A total bacterial count of 150,000 per gram at 37° C. (98.6° F.) is reasonably low, whereas 1,500,000 bacteria per gram is excessive in the finished product.

The freezing should be done in a clean container. One hour should be the maximum holding time at 70° F. after packaging before freezing, and with shell-fish this holding period should be reduced. For fruits and vegetables, the maximum holding time for safety is 24 hours at 40° F., 5 hours at 50° F., and 2 hours at 80° F.

The storage of containers should be in a compartment not used for other purposes and free of dust, flies, and vermin. All chemicals, sugar and salt should be protected against dust and air contamination. Other sweetening agents should be used with caution, as they may serve as a source of many micro-organisms. Finished products should be stored at — 10° F.

Screw conveyors are used for the removal of garbage to waste barrels, preferably made of steel. If the waste cannot be used as a stock feed it may be dumped in an open field and then covered with dirt. The waste cans should be washed and sterilized. Combustible materials that are of no use should be burned.

Sanitation is a term used to indicate that a surface is physically, chemically and bacteriologically clean. While there is no all-purpose detergent or germicide, we would recommend the use of: (a) caustic soda in a 2 or 3 percent solution used at a temperature between 110° F. and 140° F., (b) sodium metasilicate in a 0.2 percent solution, or (c) tri-sodium phosphate in a 2 percent solution. Sodium carbonate and polyphosphates are chiefly used in combination with other detergents.

Germicides with high germicidal value are the cationic agents. They are used to best advantage in pure water and in an acid solution. Active chlorine from a hypochlorite or liquid chlorine is germicidal in very low concentrations but should not be used for less than 2 minutes contact in a concentration of 100 p.p.m. of residual chlorine.

Hot water will kill vegetative forms of bacteria in ½ minute at 212° F. but requires 2 minutes at 180° F. Steam will kill them if it heats the material containing the bacteria to the above temperatures for the specified times. A steam-gun with a fin nozzle can be used, with a detergent, at 65 lbs. pressure and is of value for cleaning floors and equipment, but free-flowing steam has little killing effect. We recommend the use of a detergent prepared by any reputable company. Since the cost of the detergent is a relatively small part of the total cleaning cost, the slightly higher cost for the advice and experience of the company representative can be easily justified. The company representative should demonstrate the suitability of the product for the particular job, the best method of application, and a simple test for control of the actual concentration of the cleansing agent.

Waste disposal may be accomplished by any one of a number of relatively satisfactory methods. The most common one is dilution where the wastes from the plants are discharged directly into a neighboring stream or river. This method is objectionable at times and eventually the processor will have to institute some form of treatment to prevent the gross pollution of streams. A thirty-mesh-to-the-inch screen of a rotary or vibrating type will separate the solids, allowing discharge of the effluent into a stream or facilitating further treatment of the waste. Surface or subsurface irrigation and sand filters may be necessary to treat the effluent from the mechanical screening. If the pH value is in the acid range, it may be necessary to adjust the reaction to get satisfactory decomposition.

Another method makes use of drying beds and the subsequent incineration of the solids. A sand bed 12 inches deep with under-drains affords a method of disposal without the need of screening the effluent. An original 4 inch depth of the waste-liquid on the sand bed is allowed to dry for 24 hours. The solids are then shoveled into a wheelbarrow and transferred to an incinerator. The use of lagoons in series is also a good method if the rate of flow can yield a 20-day retention. Pumps for

recirculation are sometimes desirable in order to maintain sufficient dissolved oxygen. The addition of sodium nitrate also increases the oxygen available. A single lagoon, 3 feet deep, will take care of one million gallons per acre. A depth greater than five feet is not recommended. The size of the lagoon is based on an estimate of 25 gallons of water per case (46 lbs.) of frozen food.

Appearance, sanitary habits and the health of the employees are part of any sanitary inspection. Clean working clothes, easily laundered, should be supplied to all workers. A suitable place to change clothes and locker space must be provided. Use of tobacco and consumption of food in the same room where the food is processed should not be permitted. Plenty of warm water and soap for washing hands must be available. Health examinations are desirable for protection from workmen's compensation claims but are not generally required. Daily inspection of workers is of more value. Drinking fountains should be the angle jet type placed at the edge of the bowl. A water temperature of 48° F. is desirable for drinking water.

There is no substitute for direct responsibility when assigning authority for the general sanitation in the processing plant. Prevention of the contamination of good, clean, wholesome food by careless operators would seem to be a reasonable request. There is probably no unit operation that produces greater value in the ultimate quality and wholesomeness of the food product in return for such a small expenditure.

HANDLING AND STORAGE OF FRUITS AND VEGETABLES FOR PROCESSING*

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(REVIEW PAPER)

The importance of considering the respiration factor in storing raw fruits and vegetables is indicated. For certain perishable vegetables, if good quality is to be obtained, the only alternative to processing within a couple hours after harvesting is artificial cooling. Specific temperatures are recommended for the storage of raw fruits.

The purpose of this paper is to outline briefly some of the essentials of good handling and storage practice for fruits and vegetables. The development of new methods and equipment especially adapted to canning and freezing may come about some day, but for the present, great improvement could be made by the application of knowledge already available. A large amount of experience has been gained by the shippers of fresh fruit and vegetables on the handling and storage of specific commodities. This information has formed the foundation of today's produce industry, which has grown up to a large degree thousands of miles away from the consumer. Despite the handicap of distance to market, large volumes of perishable products of the farm, such as lettuce, asparagus, peas, and soft fruits, are shipped successfully each season. By comparison, the processor has a much simpler problem, that of protecting the commodity usually for a day or two until processed, as compared with ten or twelve days required for cross-country shipment by rail.

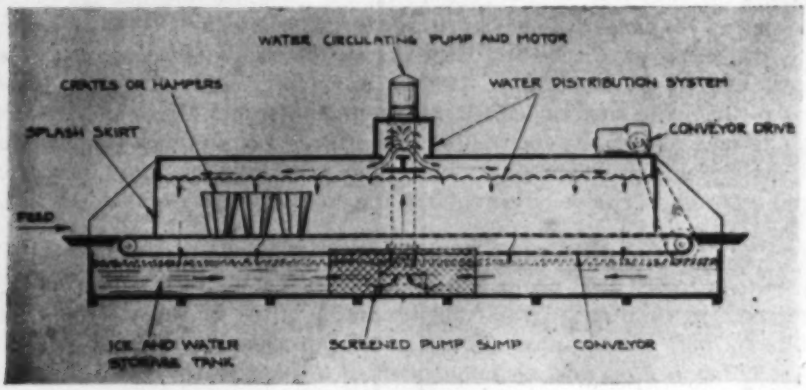
HANDLING PERISHABLE VEGETABLES

On visits to frozen food plants and canneries over a number of years past, some of the methods in use revealed a startling ignorance of the damage done to fruits and vegetables by high temperatures. Let us use spinach as an example of one commodity often abused. It is a common practice to harvest spinach in large crates, and to fill them tightly with this vegetable. The crates may stand for several hours in the field, before they are hauled to the plant where again there may be a delay, sometimes overnight, before processing. If your curiosity compels you to push your hand into the crate, as mine did, you will find the spinach warm, sometimes hot, in the center of crates that have been standing for a half day or longer. Temperatures of 85° to 100° F. are not uncommon. Some of the spinach will have started to deteriorate from bacterial soft rot, as is indicated by bruised areas on the leaves, becoming water-soaked and slimy. Some yellowing from overheating may be found. How about losses in sugar content and freshness which all add up to inferior quality in the processed product? As soon as the spinach is dumped from the field crate, modern methods take over and it is almost automatically turned into a finished package. Unfortunately, pre-processing methods are not so modern. What are some of the things that should be done to improve handling? In the first place, a commodity that gives off vital heat as fast as spinach, broccoli, asparagus, peas, or corn should never be packed tightly into a large container. If large crates, such as the lettuce crate, must be used, they should be filled loosely to give the heat a chance to get out of the mass. If good quality is desired, there is much more to be done. Processing within an hour after harvest or quick cooling and holding at cold

* Presented before the Seventh Annual Food Conference, Boston, Mass., June 4, 1947.

temperatures are called for. For all of the vegetables mentioned, hydrocooling in the field would be beneficial. The liberal use of crushed ice in the field crates would be an alternative to precooling. A refrigerated room for receiving perishable produce will some day become as important to the processor as the equipment he now uses for preparing the commodity for freezing or canning. Then, unavoidable delays will not play havoc with quality as they do today.

Handling practices for asparagus are generally better than those observed for spinach and broccoli. This vegetable is harvested in the California districts in loosely filled, shallow field boxes about six inches deep. Sometimes, the cut spears are left in the field too long or the field boxes are stored without refrigeration overnight at the processing plant. These are not good practices and much could be gained in quality by shortening the interval between harvest and processing or by using refrigeration, if delay cannot be avoided. Consider for a moment the accepted practice for shipping fresh asparagus to eastern markets. It is packed in the field soon after cutting or is brought to the packing house and packed within a few hours into bunches that are placed in ventilated crates containing a wet pad of moss or paper on which the cut butts rest. The packed crates are then immediately passed through a "hydro-cooler" (FIG. 1) where they are deluged with 2,000 gallons of



Courtesy of Food Machinery Corporation, San Jose, California

FIG. 1. Hydrocooler.

water per minute at 33° to 34° F. The asparagus is in the hydrocooler for about fifteen minutes, which is sufficient time to cool it to 36° or 37° from initial temperature of 80° to 85°. The crates are loaded at once into refrigerator cars. When loading is completed, the asparagus may be precooled further with portable fans. The bunkers of the car will be replenished daily with ice and a total of 25,000 to 30,000 pounds may be used in addition to the 6,000 to 8,000 pounds needed for hydrocooling the 20,000-pound carload of asparagus. By this method, the temperature of the asparagus is lowered to 36° to 38° within a few hours after cutting and it will be held close to such temperature, until it reaches the market. Refrigerated retail display cases are fast coming into use to give extended protection for perishable fruits and vegetables after reaching the market.

In the discussion of handling practices for the processor, the first 24 hours after harvest should be emphasized. This is the period during which deterioration often takes place at the most rapid pace. Respiration studies of freshly cut asparagus illustrate this point (FIG. 2). Bisson, Jones, and Robbins *(2)* have shown that loss of sugar and gain in crude fiber (the tough principle in asparagus) are the

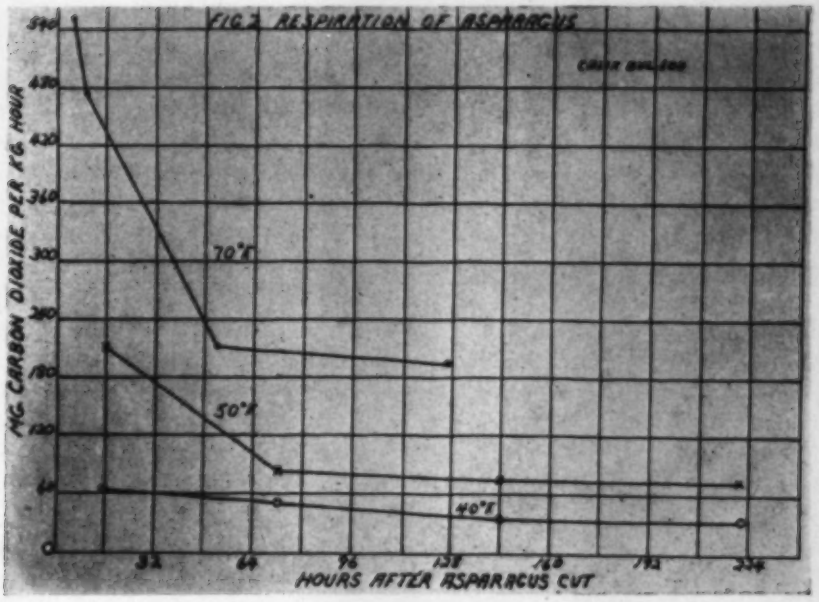


FIG. 2. Respiration of asparagus.[a]

greatest during the first 24 hours after cutting. Temperature has a marked effect on respiration and chemical changes, as these studies demonstrated.

The work of Platenius *(12)* on the rate of deterioration of fresh vegetables at different temperatures is particularly apropos to a discussion of good handling practices. The effect of temperature on sugar loss from asparagus, sweet corn, and peas was studied (FIG. 3), and it was found that loss was slowed down very much by temperatures of 50° F. or lower. In this work, the flavor of the vegetables was affected noticeably by a loss of 30 percent of their sugar. Bisson *et al. (2)* and Parker *(9)*, working with string beans, have indicated that loss in eating quality cannot be expressed adequately by sugar content, fiber, etc., nor is there visual evidence of loss in eating quality in many commodities. Platenius *(12)* found that peas and corn may have an attractive appearance after holding for several days at room temperatures but when sampled they were utterly lacking in sweetness and flavor. Most of us have had this experience with these commodities.

A practical test on retention of quality in sweet corn was made by Morris *(8)*. He found that cooling sweet corn to 50° F. in ice water and then shipping it in top-iced trucks overnight to market did not provide enough refrigeration to retain quality. By the time the corn reached the wholesale market, it had warmed to 60°, despite top-icing; and it was 70°, when it reached the retailer. About half its sugar was gone and quality was only fair. When 35 pounds of crushed ice was placed in the crates, in addition to precooling and top-icing, the corn was 40° by the following morning and there was enough ice left in the crates to protect it until it reached the retailer. The consumer obtained "sweet corn" that was really sweet.

Some idea of the heat-generating capacity of fruits and vegetables can be obtained from their respiration rates. The B. t. u.'s per ton per 24 hours, assuming glucose to be the heat source, is shown in FIG. 4. Note that the extremely perishable

[a] Calif. Exp. Sta. Bull. 600. W. T. Pentzer, *et al.* (1936).

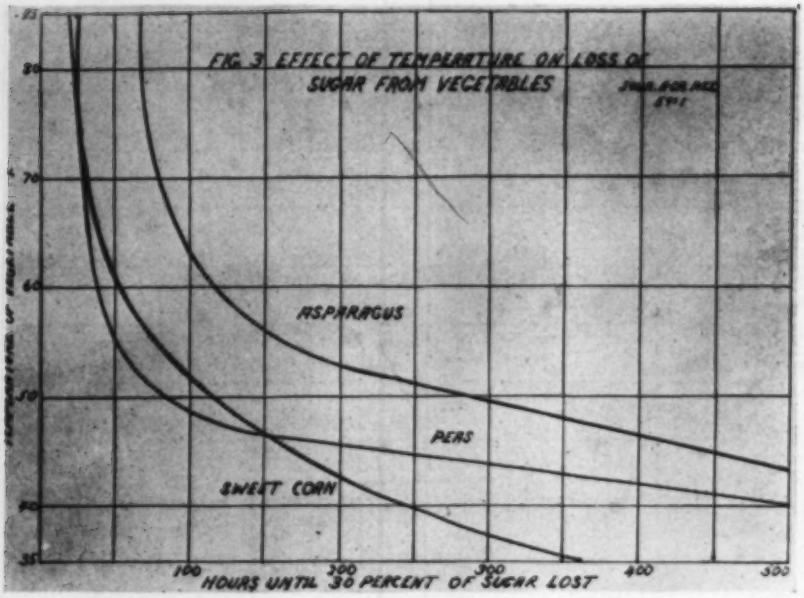


FIG. 3. EFFECT OF TEMPERATURE ON LOSS OF SUGAR FROM VEGETABLES
ASPARAGUS
PEAS
SWEET CORN
HOURS UNTIL 30 PERCENT OF SUGAR LOST

FIG. 3. Effect of temperature on loss of sugar from vegetables.[b]

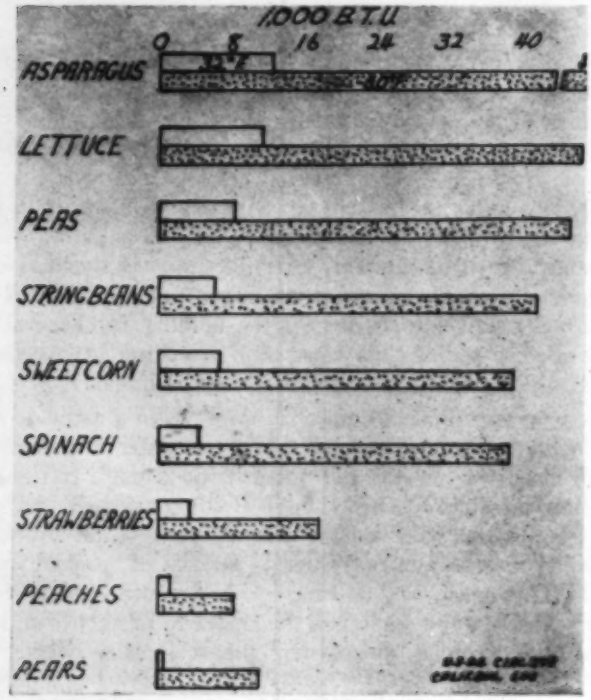


FIG. 4. Vital heat per ton in 24 hours.[c]

[b] J. Agri. Res., 59, 1. Hans Platenius (1939).
[c] U. S. Dept. Agri. Circ. 278, D. H. Rose, *et al.* Calif. Exp. Sta. Bull. 600 (1939).

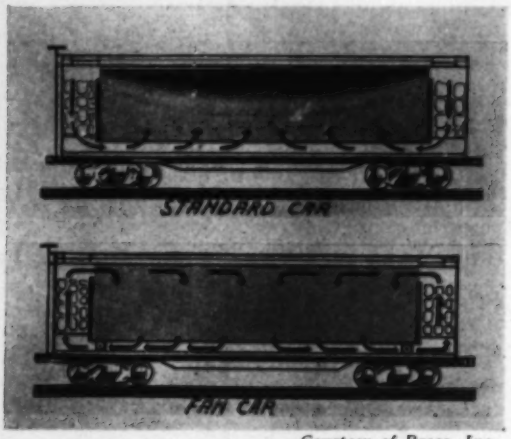
vegetables—asparagus, lettuce, peas, string beans, corn, and spinch—are at the top of the list. All of these, with the exception of lettuce, are vegetables important for canning and freezing. A ton of peas, string beans, corn, or spinach gives off approximately 40,000 B. t. u. of heat in 24 hours when stored at 60° F. *(13)*. If none of the heat could escape, the vegetable would show a temperature rise of about 20°. An example of what actually took place in bushel baskets of spinach was shown by Platenius *(12)*. Spinach of 90° temperature was stored at 80° and it warmed some, staying close to 95°; when stored at 65°, it never cooled much below 80°. When 90° spinach was stored at 50°, it cooled to 60° in about 24 hours and then gradually to 57°; and that stored at 35° cooled to 36° in 50 hours, and remained at this temperature. Low storage temperature was the answer to controlling heat of respiration. This experiment illustrates an important principle in the refrigeration of fruits and vegetables with high respiration rates. Quick cooling to low temperatures prevents heating. Precoolers and storage men will testify to this for they can recite experiences they have had in receiving a carload of "hot" vegetables, and finding themselves unable to do much cooling because "heating" had started. There is an actual saving in refrigeration requirement through quick cooling, aside from the retention of quality. As an example, a carload of asparagus held at 70° would give off enough vital heat in the first 24 hours to melt about 8,000 pounds of ice *(11)*. If it had been cooled to 32° at once and held at this temperature, the heat liberated in 24 hours would have represented a meltage of 870 pounds, or about one-ninth as much. The difference in ice meltage of approximately 7,000 pounds, if expended on cooling the asparagus quickly, as in ice-water cooling, would have been more than enough to cool the 20,000 pounds of asparague from 70° to 32°.

Another experiment, made with corn, applies directly to the subject of retaining quality in perishable vegetables. Mallison and Pentzer *(7)* showed that in as little time as three hours, sweet corn lost about 14 percent of its sugar, if held at 70° F. after cooling for an hour in ice water. When held at 32°, there was no loss in three hours, about 3.7 percent in 24 hours, and 7.6 percent in 72 hours.

Many other workers have dealt with the question of temperature effect on changes in chemical composition and quality of vegetables. Deterioration from microbiological activity is also markedly accelerated by high temperature. There remains little doubt that if the processor is to retain quality and protect highly perishable produce from spoilage, he has a choice of prompt utilization, meaning usually within an hour or two after harvest, or quick cooling and low storage temperature. The first is usually not practicable, since harvest operations cannot be geared so closely to processing. The alternative, that of using refrigeration, appears to be the most applicable. A word of caution is offered here. Placing vegetables in a cold room will not necessarily accomplish quick cooling. The amount of surface exposed and air temperatures and velocities will be the determining factors in heat removal. Likewise, to get rapid heat transfer in water cooling requires large volumes of cold water (32°-35° F.) passing through the crates at good velocities. Standing vegetables in tanks of water does not bring about fast cooling, as was indicated by the experiments made with corn mentioned above. In the development of the present "hydrocooler," the design finally chosen relies upon moving several thousand gallons per minute over the commodity, rather than moving the commodity through tanks of water, where much lower velocities would be obtained.

HANDLING FRUITS

The handling of fruits for processing, as a rule, offers fewer problems than vegetables. Some fruits, however, are almost as perishable. For example, strawberries and other berries, cherries, peaches and nectarines, can spoil within a day's time, if temperatures are high enough to favor the growth of fruit rots. Prompt processing is called for or quick cooling and storage. All of these more perishable fruits should be stored at temperatures of 31° to 32° F. *(13)*. Sometimes these fruits are shipped considerable distances to the processor. Precooling before shipment is recommended and, if movement is by rail, the use of refrigerator cars of new design having air circulating fans is suggested (FIG. 5). For a discussion of the physiology of fruit storage, the reader is referred to an article by Smock *(14)* on this subject.



Courtesy of Preco, Inc., Los Angeles, California

FIG. 5. Air circulation in standard and fan cars.

PEACHES

Peaches are often stored several weeks prior to canning to facilitate packing of fruit mixtures, such as fruit salad, and to smooth out peaks in harvest operations. It is important that they be stored at 31° to 32° F. and not at 36°, 40°, or 45°, for at these higher temperatures, peaches develop browning of the flesh and a dry mealy texture sooner than they do at 31° or 32° *(5)*. In fact, it was found in some work done by the author in 1945 (unpublished) that as little as 12 days' storage at 45° was long enough to cause breakdown to develop during ripening in some tests made with Elberta and Hale peaches (FIG. 6). A clingstone variety, Libbee, showed severe browning when ripened after three weeks of storage at 40° or at 45°; peaches ripened normally after 36° and 32° storage. Storage life was longest for all varieties at 31°-32°, but 30 days or less was the limit because of breakdown. Nectarines probably have the same susceptibility to injury at 40° to 45° as do peaches; at least one variety, Gower, showed typical breakdown from 12 days' exposure to 45°. The refrigeration capacity of the storage rooms should be adequate to cool the fruit to 32°-34° within a day or two; if not, the fruit should be precooled before storage. This is mentioned because the peaches may be heavily infected with rots as they come from the orchard. The common peach rots, such as brown rot and rhizopus, make considerable growth at 40° to 50°, whereas development is slow or practically nil at 32°.

Precooling peaches in a hydrocooler before storage, adding chlorine to the water as a disinfectant, is a new treatment, which will be tried on a semi-commercial scale this coming season as a means of reducing losses from rots in storage.

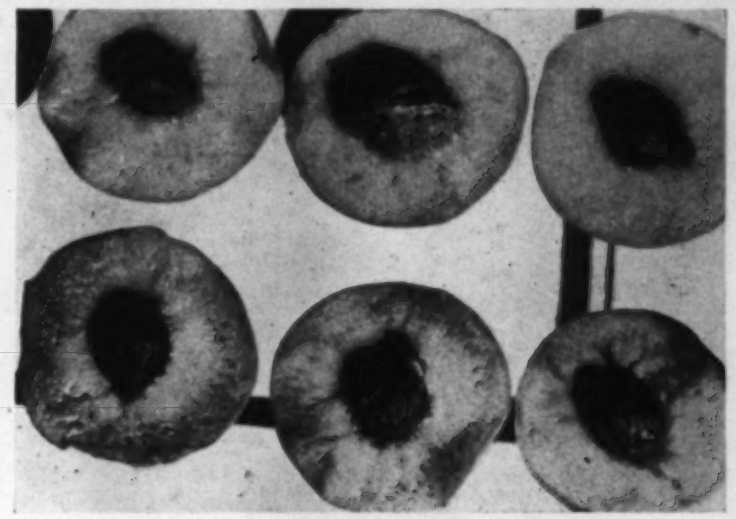


FIG. 6. Elberta peaches.
A. Normal.
B. Breakdown due to 13 days storage at 40° F.

PEARS

The most common trouble with pears that the canner encounters is probably breakdown of the flesh, which usually appears during ripening, but sometimes in storage (FIG. 7). This almost always means that the pears were allowed to become

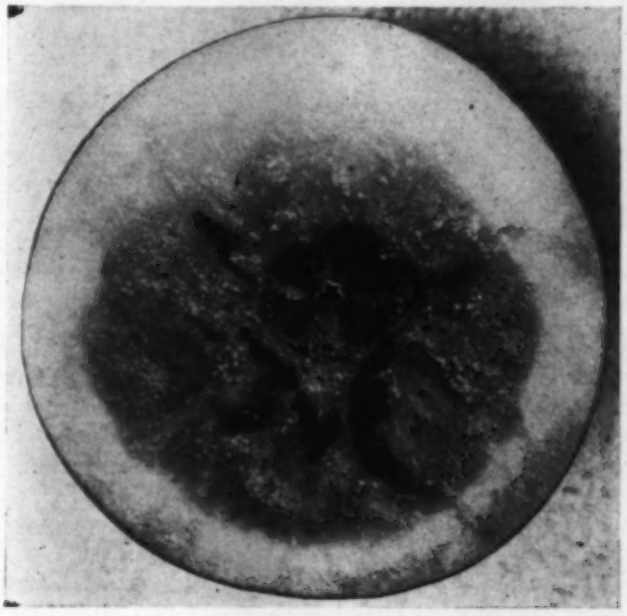


FIG. 7. Core breakdown of pears.

too mature before they were picked, or they were held too long in storage or in the ripening room. The relationship of time of picking to core breakdown of Bartlett and other varieties of pears was brought out most clearly by Hartman *(6)*. The use of hormone sprays to prevent the natural drop of pears has complicated pear storage by encouraging delay, beyond the proper time for harvest. Allen *(1)* and Gerhardt *(11)* have shown that the hormone sprays, in addition to keeping fruit on the tree that was ripe enough to drop, may also accelerate the ripening of late pickings of pears.

Storage at high temperatures will also shorten the storage life of pears and may hasten development of breakdown and other storage troubles, such as scald (FIG. 8).

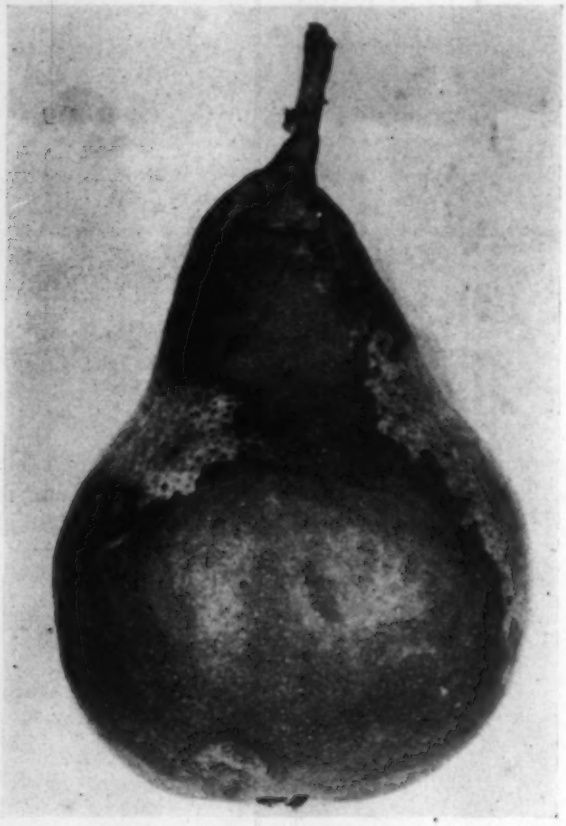


FIG. 8. Scald on Bartlett pear.

Therefore, it is good practice to get fruit into storage and cooled in as short a time as possible after picking. Storage temperatures of 29° to 30° F. are recommended for Bartlett pears.

It is believed that, in some localities, canners are not ripening Bartlett pears at the most beneficial temperature. Recent tests with California Bartlett pears have shown that best quality was obtained by ripening at 65° to 67° F. and that definite retarding of softening and coloring, poor flavor, and surface breakdown (FIG. 9) may result from ripening pears at temperatures of 75° to 85° *(10)*. Fruit ripened at about 70° to 74° was less desirable than that ripened at 65°. In this respect, these results do not agree with those of Ezell and Diehl *(3)* who found that 70° to 75° was

FIG. 9. Bartlett pears showing typical browning and soft breakdown from ripening at too high temperature, 80° to 85° F.

as good as or better than 60° to 65° for ripening Washington-grown Bartletts. The latter temperature range caused some darkening of the canned product. They found, as we did, that higher temperatures of 80° to 85° or 90° definitely retarded ripening, and 90° injured the appearance. Temperatures as high as these are sure to be encountered in the interior valleys of California during the season that Bartlett pears would be ripened for canning. Thus, some refrigeration for ripening of Bartlett pears is called for in these localities.

One or two instances have been encountered in which storage breakdown of cannery Bartletts was due in part to shipment in poorly refrigerated cars. Occasionally, pears are shipped a thousand miles or more for canning. It is essential that they be precooled before shipment and be transported at cool temperatures, if long storage life is desired. Shipment in fan cars is suggested.

CONCLUSION

This discussion has been confined to a few commodities that are either frozen or canned in fairly large quantities. The essentials of good handling, that is, quick utilization or prompt cooling and storage, will apply to perishable commodities not mentioned such as tomatoes, lima beans, brussels sprouts, and others. For recommended storage temperatures, U. S. D. A. Circular 278, The Commercial Storage of Fruits, Vegetables, and Florists' Stocks, should be consulted. Methods of refrigerating fruits and vegetables, intended for fresh shipment, have been developed that might well be employed by the processor. "Hydrocooling" of vegetables is one example, top-icing and package icing is another, use of precooling fans in refrigerator cars or in precooling rooms, and shipment in fan cars are other examples.

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QUALITY CONTROL OF FROZEN FOODS [a]

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(REVIEW PAPER)

The importance of quality control in packing frozen foods is emphasized. Economic problems involved far outweigh the technological problems. All grading standards need attention but sanitary quality requires preferential treatment. Standards of sanitation are discussed.

The frozen food industry itself has acknowledged the need for setting up its own standards. The factors which recognize this need, for the most part, are the larger and more experienced ones. They realize that high quality is obtained only through standards. They also realize the difficulty of adhering to standards, especially under conditions existing today. Unfortunately, advocates of standards are not very specific and to many of the less experienced packers, such words as "standards" and "quality control" are confused with "grade labeling."

Unfortunately, quality control may have an ominous ring to certain packers who may have been careless about setting up quality standards in their own operations. Some packers who may be trying to do a quality job are actually scared by the words quality control and quality standards because of the confusion resulting from attempts to force grade labeling on the industry. The reason for this may lie in the implication that quality control standards are difficult to attain and more difficult to enforce. Actually quality depends on observing a few fundamental rules which are easy to understand and easy to carry out. There is no need for fear or confusion but there is great need for complete education.

Quality control neither begins nor ends in the packing plant. It begins on the farm and ends in the consumer's kitchen. The packer, for instance, cannot guarantee that the product was transported, warehoused, merchandised and finally handled properly by the housewife. Thus each factor is just as responsible as the packer for the final quality. This is probably more true for frozen than for canned goods, of course. Therefore, standard practice instructions for frozen foods must be set up for the farmer, packer, transporter, warehouseman, merchandiser, and housewife. Yet each of these factors "bristles" when told of his responsibility.

Unless one studies carefully the economics of grading produce, it is difficult to understand the position of the packer. The first step in such a program is to pay the farmer more for his highest quality. This approach immediately gains the confidence and cooperation of the farmer and costs the packer nothing if he can pass on the extra cost to the retailer. It is then up to the retailer to educate the public to the real money values represented by various items. The farmer will then put the extra income into increasing the percentage of his high quality products. The public will not enjoy consistently high quality until this becomes possible. The opposite approach is, of course, lower prices to farmers for lower qualities. Advocates of this policy do not seem to realize that in a highly competitive low profit-margin business, the average price is the break-even price and that growers must produce better than average quality in order to break even. A grower must be allowed some profit on even his poor production in order to be happy. If he receives a bonus for his high quality he will produce more of high quality. Under present methods he has little incentive to spend time and money to produce higher quality foods.

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[a] Presented before the Sixth Annual Food Conference, Buffalo, N. Y., March 20, 1946.

The technological problems of quality control may be almost infinitesimal compared with the economic problems involved. Pressure groups may succeed in forcing compulsory standards on the industry but by doing so they are liable to defeat their own purposes in upsetting the law of supply and demand—by trying to gain their ends through short-cut methods.

On the other hand, although purchasing raw products by grades may be the first important step in formulating a quality control program, it is by no means the only one. I have attempted thus far to show that this first big step in any quality control program can be justified on economic grounds. The remaining controls may be classified under technological considerations. Let us consider some of the details involved in setting up both grading and sanitation standards.

SETTING UP GRADING STANDARDS

The purchase of farm produce according to grades and standards need not be feared by packers once they are assured that such standards supply a more quality-conscious market and that the higher grades will bring higher monetary returns without depreciating the price of that portion of the pack which may be of lower quality.

Many canners and their farmer resources are already very familiar with methods of payments based on quality. Asparagus, for instance, is valued for the length of the green part of the spear as well as for its diameter. It takes experienced judgment because there is much opportunity for personal error. Accordingly, practically all packers of asparagus hire a federal or state grader and pay the farmer on the basis of the standard federal or state grades. The grader is responsible to neither buyer nor seller and therefore is acceptable to both as an impartial arbiter. Tomatoes are valued for their full ripeness and freedom from cuts and bruises. Since the tomato juice industry has become so important, such impartial grading-inspection has become a necessity. The orange growers of California, the apple growers of the Pacific Northwest, the cranberry growers of Cape Cod, all have been selling their produce on a quality graded basis for years and in each instance there has resulted a very stable grower-packer relationship based on fair financial returns for each. Thus, there is much experience to prove that the food industry as a whole is not adverse to using grades and standards when the result is financial satisfaction rather than financial hardship.

SANITATION CONTROL IN FROZEN FOOD PLANTS

Although product control through grades and standards is important, it is just as important to set up technological controls such as methods to test the adequacy of blanching and sanitation procedures used in the factory.

The Three Objectives of Plant Sanitation. The exclusion of pathogenic and toxigenic bacteria from the product, the prevention of bacterial fermentation during processing and the reduction of contamination in the final product are the three aims of sanitation in a frozen-food plant.

Sanitation Inspection Methods. A sanitary survey usually is the first step in setting up control techniques. Local or district health laboratories will test the water supplies without cost. In case the factory laboratory does not have the facilities for a routine check, a private consulting laboratory or the state experiment station can usually supply both personnel and equipment to make a complete survey of all incoming supplies of foods and containers, of all handling equipment, of the product after passing through each piece of apparatus and again at intervals after packing, and both before and during the freezing process until the product is finally

frozen and the bacterial population thus stabilized. It may take a week to complete such a survey.

The sanitary survey points out the most likely sources of contamination. Accordingly, if the daily check counts should later show a sudden increase, an inspection of only a few sources of contamination will usually disclose the trouble. After both a specific and general cleanup, fresh counts will prove the effectiveness of the treatment. If the trouble has not been eliminated, a complete line check should be made immediately; again calling in a private laboratory or experiment station worker to solve the difficulty should this outside help be necessary.

Sanitation Laboratory Techniques. Laboratory control can be relatively simple and can be added to the duties of the regular quality control inspector-grader. The inspector ordinarily takes samples several times during the day to cook and taste them as a check on his grading efficiency. One of these samples should be one of the last packages of the day's pack which the line operator has marked so that the next morning it can be brought to the attention of the inspector who will then take a bacteriological sample before conducting his regular cooking test on the product. To make this as simple as possible to perform, the time-consuming operation of sterilizing supplies can be eliminated by using ready prepared pipettes, plating media and dilution water purchased from a nearby commercial laboratory. Thus, only the daily rinsing of a few petri dishes and pipettes and counting of plates becomes necessary. One hour daily will suffice to do a very effective control job. Arrangements for rapid elimination of troubles which may be discovered through such a method of checking, must be handled expeditiously as such troubles not only do not correct themselves, but rather multiply in seriousness if correction is deferred. Summarizing, once the inspector has been trained to know the usual sources of trouble, how to recognize the exact source, and how to correct the actual difficulty, the sanitation problem need cause no worry. Only when he is unable to discover the trouble is outside help called in. This is merely a matter of again calling in the experiment station or the private laboratory equipped for making another survey.

The manipulations by the inspector in the laboratory are simple. A small sample of frozen product is weighed into a tube of sterile water, mascerated if necessary, and shaken a little. It is then pipetted into standard dilution waters and then the various dilutions, after shaking, are pipetted in triplicate into sterile petri dishes. The nutrient agar or other medium which has been melted by standing in hot water is poured into each petri dish. The latter is then swished around to mix the medium and the sample, allowed to cool and then incubated in the inverted position at 30° C. (86° F.) for 72 hours before counting. Methods are now available by which direct microscopic counts give fairly accurate results in 16 hours. However, this takes specialized equipment and personnel and the expense may not be justified for small operations. (To avoid expense of a special incubator a thermostatically controlled, light-bulb heated, Celotex box may be improvised).

Factory Cleaning Devices. The foregoing method proves quite satisfactory in plants where few troubles occur such as where continuous cleaning devices are used on each piece of apparatus and where sanitary type fixtures and non-corrosive, polished metal surfaces are the only materials with which the food comes in contact. Continuous sprays of clean water playing on such equipment prevent films from forming. These films are usually serious sources of contamination. Inspection belts may be serious contaminants. New rubber belts are satisfactory but old rubber belts are usually grained with fine surface cracks which harbor bacteria and food materials on which bacteria can feed. Canvas belts are never satisfactory. In a previous paper, "Quality Control of Frozen Food Production," (Ref. Engineering, May,

1939), the writer described three types of stainless steel belts, namely: (1) solid belts, (2) solid narrow strips and (3) perforated plates or strips. The strips are placed crosswise and are mounted with only a minimum of space between them. Stainless strip or plate belts do not have to be replaced as they do not wear and in spite of higher first cost pay for themselves—not only in low replacement cost but also by reducing bacterial contamination and therefore control expense. Poor equipment is a constant source of expense, trouble and worry.

Drain pans, tote buckets, baskets and the like *must* be cleaned after each use. A very satisfactory method is to set up a continuous conveyor on which such receptacles are carried through a strong detergent bath, a spray rinse and then are delivered, washed and drained, back at the starting point so that one person can operate it. A less expensive apparatus which can be satisfactorily operated is the can-rinsing apparatus used in dairy plants.

For a final clean-up, many plants keep the workers for ten or fifteen minutes at the end of the day. This is seldom satisfactory as weary workers cannot do a thorough cleaning job. If the plant is kept picked-up during the day and the various pieces of apparatus are automatically or at least continually rinsed, then scums will not form. When the plant is shut down, however, each scum which has started to form will set. Its removal requires a thorough scrubbing of each food handling surface, using good detergents and stiff-bristled brushes. Finally, a good steam-hosing is necessary to remove the last vestiges of food materials which may have become lodged in inaccessible places. It is advisable to train a special clean-up crew and provide it with a competent boss and adequate mechanical cleaning equipment and materials. Such a crew should only be large enough to thoroughly clean the plant during the long shutdown period at night. This cleaning should include, in addition to the food handling equipment, toilets, grease traps and drains as well as the factory floor, floor racks, tables, chairs, benches and, once a week, the walls.

To be more specific, before starting a plant in the morning, each piece of apparatus should be given a thorough rinsing to remove mold and bacteria-laden dust which may have settled over night. Likewise, when shutting down the plant for the noon and evening meal respites, all food handling apparatus must be thoroughly rinsed so as to avoid formation of scums during the shutdown period.

General Factory Sanitation. The factory should have plenty of good lighting and ventilation, efficient drainage, ample water supply, and smooth hard-surfaced walls and ceilings which may be hosed down frequently to remove mold contamination. Dogs, cats and rats should be excluded from the premises. Food and packing materials, which may attract rats, should be kept in rat-proofed rooms. The washing facilities for the packing room crews should be outside the toilet rooms where all employees can be checked as to washing hands before returning to their places on the packing line. Soil lines must be separate from plant waste lines to a point outside the plant walls. Waste disposal, such as agricultural waste from food culling and trimming operations, should be removed so far from the plant that it cannot become a nuisance as a source of flies and other insects. The windows and doors should be thoroughly screened and the doors equipped to close automatically. Material entering or leaving the plant during the operating season should travel on a conveyor through a flapped, small opening. Seldom allow a truck to back into a food plant any more than into your own kitchen.

Very few plants are equipped or manned so as to meet the above requirements. In fact, the trade has no idea of the actual conditions in the industry or it would be far more active in exerting pressure toward improvements. The public may not be interested in the fact that the cannery may sterilize the product at the end of the

production line, or that the bacteria picked up in the plant are preserved along with the foods in the frozen food operation. However, the public recognizes high quality which results from good handling procedures.

Sanitation Standards. Public health officials have often suggested that maximum bacterial counts be placed on all processed or preserved food products whether or not they have been sterilized by heat as in canning. Standard bacterial counts, mold counts, and insect fragment counts have been suggested for frozen and dried eggs, tomato products, fresh crustacean meats and numerous frozen foods. Such standards usually have the public interest in mind. In the case of frozen foods, they not only have to do with the present condition of the product, but also with the possible troubles which might occur in the housewife's hands as the result of careless handling.

Although it is possible to be specific with respect to sanitary standards for frozen foods, there is no general agreement among investigators as to what the actual standards should be. The Frozen Food Foundation has set limits on certain types of contamination or infestation which it believes can readily be met in well-managed and moderately well-equipped plants. It advises its members to accept for sale only merchandise which does not exceed the following "purity" limitations:

a. Bacterial plate count [a] 500,000 per gram.

b. Most Probable Number [b] (M.P.N. value), 100 confirmed coliform organisms per hundred grams of product.

c. Positive mold count, 50 out of each 100 fields.

d. In the case of frozen peas and beans, weevil count, 1 for each 10 peas or beans.

e. Insect fragment count, 0 large or 10 minute insects per package.

The bacterial count may be very important in preventing troubles in such items as frozen cooked foods, after defrosting as well as during storage.

CONCLUSION

Distributors and retailers have a very powerful story with which they can approach packers to impress them with the importance of quality in the frozen food industry. Hitherto they have had available only what the industry offered. The institutional trade, in the past, has absorbed much of the lower quality production but since this field is fairly well saturated, the expansion to come may be primarily in the home consumer field where quality consciousness is keen. This may mean that poor quality merchandise may have to sustain serious markdowns in the future which can no longer be avoided by dumping it on the institutional market.

Although distribution controls were lacking during the early stages of growth of the frozen food industry, they have advanced more rapidly than factory controls during recent years. Some retailers are even providing home owners with storage cabinets to complete the cycle of protection of quality during distribution. Although as yet quality control of factory operations continues to be an unknown quantity, certain parts of the industry are talking about setting up standards.

Once the demand for quality control services becomes a reality there will be a great demand for trained frozen food technologists and then it will be discovered that there is a lack of trained personnel. Therefore, some such simplified method of sanitation control as explained above may become a practical necessity instead of just an economic expedient.

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[a] Microbiological Examination of Foods, A.J.P.H. 36, 332-5 (1946).

[b] Report of the Standard Methods Committee, A.J.P.H., 33, 587 (1943).

Current Patents and Patent Litigation

INVENTION IS A FLASH OF GENIUS

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A few years ago the Supreme Court of the United States in *Cuno Engineering Corp. v. Automatic Devices Corp.*, 314 U. S. 84 (1941) held that certain claims of the Mead Patent (1736544) for a cordless cigarette lighter used in automobiles were invalid for want of invention. In this case Mr. Justice Douglas said:

> "For it is our opinion that the Mead device was not the result of invention but a 'mere exercise of the skill of the calling,' an advance 'plainly indicated by the prior art'."
>
> *Altoona Publix Theatres v. American Tri-Ergon Corp.*, 294 U. S. 477, 486. (p. 88.)

He then pointed out that this rule was one of long standing:

> "Since *Hotchkiss v. Greenwood*, 11 How. 248, 267, decided in 1851, it has been recognized that if an improvement is to obtain the privileged position of a patent, more ingenuity must be involved than the work of a mechanic skilled in the art." (p. 90.)

Continuing his discussion of the subject of patentable invention he said:

> "The new device, however useful it may be, must reveal the flash of creative genius, not the mere skill of the calling. If it fails, it has not established its right to a private grant on the public domain." (p. 91.)

The phrase "flash of genius" created a storm that still blows over the country. It was at once charged that the Supreme Court had established a new test of invention, and that the Supreme Court was destroying our patent system. The furor pervaded scientific and engineering journals, trade papers, bar association meetings, legal periodicals and many other forms.

Opinions of the judges in patent infringement cases reflected the debates on the "flash of genius" doctrine. One judge said, in effect, that he would have none of it in his court. The gust of the storm was even felt in the Supreme Court.

In one of his dissenting opinions, *Marconi Wireless Co. v. United States*, 320 U. S. 1 (1943), Mr. Justice Frankfurter said that "genius is a word that ought to be reserved for the rarest of gifts," and as to "flash" it was "a current term in patent opinions happily not used in this decision."

In view of the terrific furor created by Justice Douglas' clipped phrase, the question naturally arises whether the Supreme Court had changed long established standards for determining the presence of invention. On reflection, it appears that the Court did not, and that those who shout so lustily against the "flash of genius" doctrine fail to understand the nature of a patentable invention, or perhaps brush it aside from their deliberations.

WHAT IS MEANT BY PATENTABLE INVENTION?

As is well known, the American patent system is based on the terse 8th clause of Section 8 of Article 1 of the Constitution, which provides that the Congress shall have Power

> "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."

In accordance with that power the Congress has, from time to time, enacted statutes providing for the issuance of patents for inventions. Aside from plant and design patents, there are four great classes of inventions: machines, manufactures, compositions of matter and arts.

To obtain a patent on a new product (a composition or a manufacture) or a new process, or a new machine the thing must not only be new but reveal invention.

The basic principles governing decisions as to newness and invention in those classes are the same.

Newness or novelty requires no discussion. The arresting topic is invention, and therefore, the question arises—What is a patentable invention?

In *United States vs. Dubilier Condensor Corp.*, 289 U. S. 178 (1933), Mr. Justice Roberts defined "invention" as follows:

> . . . the peculiar nature of the act of invention, . . . consists neither in finding out the laws of nature, nor in fruitful search as to the operation of natural laws, but in discovering how those laws may be utilized or applied for some beneficial purpose, by a process, a device or a machine. It is the result of an inventive act, the birth of an idea and its reduction to practice; the product of original thought; a concept demonstrated to be true by practical application or embodiment in tangible form."

He then distinguished invention from the embodiment disclosed in the patent, and pointed out that it was the invention that was the subject of the patent and not the embodiment:

> "Though the mental concept is embodied or realized in a mechanism or a physical or chemical aggregate, the embodiment is not the invention and is not the subject of a patent." (p. 188.)

The foregoing definition of invention was derived in part from *Pyrene Mfg. Co. v. Boyce*, 292 Fed. 480 (1923), in which the Circuit Court of Appeals said:

> "It is a trite saying that invention defies definition. Yet, through long use, the word has acquired certain characteristics which at least give direction to its meaning. Invention is a concept; a thing evolved from the mind. It is not a revelation of something which exists and was unknown, but it is the creation of something which did not exist before, possessing the elements of novelty and utility in kind and measure different from and greater than what the art might expect from its skilled workers." (p. 481.)

And as to the requirement that the idea should be reduced to practice, the Supreme Court itself had declared in *Clark Thread Co. v. Willimantic Linen Co.*, 140 U. S. 481 (1891):

> "A conception of the mind is not an invention until represented in some physical form, and unsuccessful experiments or projects, abandoned by the inventor, are equally destitute of that character. These propositions have been so often reiterated as to be elementary." (p. 489.)

A patent therefore is granted for an invention; and an invention is an idea or concept of accomplishing some useful objective when it is embodied in some physical form.

The next question that arises is—How is the presence of invention determined?

Now novelty alone had long ago been held insufficient to warrant a monopoly for the limited period of the patent. Justice Douglas cites *Hotchkiss vs. Greenwood*, decided in 1851, for the proposition that "to obtain the privileged position of a patent more ingenuity must be involved than the work of a mechanic skilled in the art."

Here then is the ancient yardstick for measuring the idea to determine if it is of patentable stature. For this purpose the courts use a hypothetical personage—the man skilled in the art—the analogue of the reasonable or prudent man so well known in Anglo-American law. The standards of conduct expected of the reasonable or prudent man are used to measure and adjudicate the conduct of the real persons involved in litigation. With the creation of the fictitious man skilled in the art it became possible to decide if invention was present.

If the novel machine or product, the embodiment of the invention, was one which a man skilled in the art would be expected to produce when the need therefor arose, there was no invention in conceiving of it. The determination of what was to be expected from the man skilled in the art entails the consideration of many factors. For example, if a new product or device, compared with the prior products or devices, exhibits improvement of relative simplicity, the mere simplicity does not negative the existence of invention. If the relatively simple improvement results in a product or device which, unaided by "huckstering" or touting receives wide spontaneous acceptance and displaces the old article, that is evidence of invention. If, in such a case, the art has for a long time sought something better than the old articles, and the new thing almost completely supplants the old, a finding that an invention is present is virtually assured.

It will be noted that nothing has been said as to how the invention came into being. That is of no moment. The idea, as revealed by the patent or in the application, is compared only with the thinking of the man skilled in the art who contemplates the problem which faces the inventor.

The invention, that is the mental concept, may have occurred in a flash, or resulted from long and sustained grappling with a problem, or sprung from an accidental fortuitous discovery. If it resulted from a discovery, the mental act, necessary for the existence of invention, was that in realizing how the discovery could be utilized. In all cases, therefore, the manner in which the inventive idea came into being is unimportant and does not require consideration.

When a court has to decide whether or not invention is present, it deals solely with the concept as a *fait accompli*. The Court does not, and is not required to probe the mind of the inventor. It deals solely with the idea revealed in the specification and the manner of its accomplishment through the embodiment described therein. The flash of thought or "flash of creative genius" with which the court is concerned is the thought or idea revealed by the specification of the patent as compared with the ideas of the prior art.

If the concept revealed in the patent is found to be one which was beyond that to be expected of the man skilled in the art, then the patent reveals a flash of creative genius.

It will be obvious, therefore, that the owner of a patent can, despite all the clamor of a defendant's experts to the contrary, establish to the court's satisfaction that a really meritorious invention is shown without testimony of the inventor or the manner in which the invention came about. Many patents have been held valid without the inventor ever going on the witness stand, or being in court.

If it be borne carefully in mind that the "flash of genius" means nothing more than the thought revealed solely by the patent specification as contrasted with the thought one would expect from the man skilled in the art, it should be apparent that the Supreme Court did not announce any new doctrine in the *Cuno Engineering Corp. v. Automatic Devices Corp.* case; and that it still is incumbent, as ever before, for the advocate to properly marshall his facts and arguments to establish that the patent or specification reveals an invention of patentable stature.

Industrial and Legal Viewpoints

ARE STANDARDS OF IDENTITY ASSETS OR LIABILITIES IN THE FOOD INDUSTRY *

FREDUS N. PETERS
The Quaker Oats Company, Chicago, Illinois

It is probably fair to say that the public and even some food technologists assume that, in the field of foods, the only effect of the Food, Drug and Cosmetic Act is to prevent the manufacture and sale of impure and deleterious foods and to insure honest labelling of food products. Thus, the myth has developed and has been carefully nurtured in some quarters that anyone opposing this law or its administration is opposed to pure food and is working against the public interest. He must have sinister motives, he is probably dishonest, unprincipled and anti-social.

Before classifying the writer, the reader is asked to remember that the following paragraphs are directed toward the effects of the Act as it is administered and not to its objectives. The writer believes he is in accord with the objectives expressed by those who sponsored the law.

To appreciate this distinction between objectives and effects, some knowledge of the historical background is desirable. Section 7 of the Food and Drug Law of 1906 defined adulteration as (1) the addition of any substance which lowered or injuriously affected the strength of the original material, (2) the substitution of a product in whole or in part for the original material, and (3) the removal in whole or in part of any valuable constituent of the original material.

Without a standard it was difficult to determine whether a product had been adulterated as defined above. Whole milk is adulterated by the addition of water or by the removal of cream, but how can one prove whether a little cream has been removed or a little water added. Or for example, how much sugar can be substituted for the fruit in preserves before the product ceases to be preserves. The housewife uses about 45% of strawberries in her preserves but a good looking product can be made with 15% of strawberries. As long as such a diluted product was made with wholesome ingredients it was not subject to the charge of adulteration provided it was sold under a distinctive name, which in the case of the preserves just mentioned was Bred-Spred. A grape beverage, simulating grape juice, but containing only 5% of the fruit juice was sold under the distinctive name of Smack.

Another abuse arose in the case of butter. At one time butters were on the market varying in fat content from 65 to 85%. The Food and Drug Division set up advisory standards but these did not have any legal standing and were interpreted by the courts in different ways.

Thus it happened, when the 1906 law was revised in 1938, Section 401 gave the Food and Drug Administrator the power to set up definitions and standards of identity whenever it was in the interests of honesty and fair dealing with the public. This section reads in part as follows:

> "Whenever in the judgment of the Administrator such action will promote honesty and fair dealing in the interest of consumers, he shall promulgate regulations fixing and establishing for any food, under its common or usual name so far as practicable, a reasonable definition and standard of identity, a reasonable standard of quality, and/or reasonable standards of fill of container. . . . "

* Presented before the Chicago Section, Institute of Food Technologists, May 19, 1947.

This section gives the Administrator the power to establish definitions and standards of identity if they are "reasonable" and if they "promote honesty and fair dealing in the interest of consumers."

Section 403 attacks such products as Bred-Spred and Smack by providing that a food shall be deemed to be misbranded if it purports to be or is represented as a food for which a standard has been established unless it conforms to that standard. It reads as follows:

> "A food shall be deemed to be misbranded if it purports to be or is represented as a food for which a definition and standard of identity has been prescribed by regulations as provided by Section 401, unless (1) it conforms to such definition and standard, and (2) its label bears the name of the food specified in the definition and standard, and insofar as may be required by such regulations, the common names of optional ingredients (other than spices, flavoring, and coloring) present in such food."

No one should quarrel with any attempt to prevent economic frauds, deception of the public, or to produce pure foods. There is no doubt that the purpose of Sections 401 and 403 was to prevent economic frauds. Mr. Walter G. Campbell, former head of the Food and Drug division said at a Senate hearing (Dunn Fed. Food, Drug and Cosmetic Act, page 1231):

> "The necessity for standards of identity for food products is an economic one."

There can be little doubt that Congress intended the words "honesty and fair dealing" to mean that the promulgation of standards would protect consumers from being defrauded by unfair practices on the part of food manufacturers. As a corollary to this it may be argued that no standards should be promulgated unless customers are being defrauded. Expressed in another way, unless there is dishonesty and unfair dealing against the interest of consumers there is no justification for establishing standards. J. Thomas Schneider, General Counsel and Secretary, Standard Brands, Inc., said in January, 1947: ["Food Drug Cosmetic Law Quarterly," 2, 36-7 (1947)],

> " . . . It is readily apparent that one of the foremost purposes of the Congress in enacting these sections was to prevent a debasing and cheapening of food products under circumstances whereby their sale would constitute a fraud upon the public by way of substitution, imitation, or injury to health."

For just a moment let us forget we are food technologists and consider section 401 as political scientists. Remember that this section reads, "Whenever in the judgment of the Administrator such action will promote honesty and fair dealing in the interest of consumers, he shall promulgate . . . etc." Remember that the rules so promulgated have all the force of law enacted by a legislative body. Here is a case of promulgation of law by the executive and not the legislative branch of the government. It is such a common practise in Washington today, few of us realize it is a radical departure from our original concept of government. Mr. Michael F. Markel, formerly an attorney for the Food and Drug Division [Food Drug Cosmetic Law Quarterly 1, 29-47 (1946)] said in referring to Section 401:

> "On its face it appears to contain no restrictions on administrative action other than that the Administrator is required to exercise judgment. I suspect that back in the days of our study of constitutional law in the class room, most of us would not have hesitated to declare this an unconstitutional delegation of legislative power."

PROCEDURE FOR ESTABLISHING STANDARDS

Generally, the first official act leading to the promulgation of a standard is publication in the Federal Register of a notice that a public hearing will be held at such and such a time and such and such a place "for the purpose of receiving evidence upon the basis of which regulations may be promulgated establishing reasonable definitions and standards of identity for"—such and such products. Such notice is customarily accompanied by proposed definitions and standards proposed by the Administrator. An attorney from the Food and Drug Division is designated as the presiding officer. Tentative definitions and standards follow [See Federal Register, 12, 1192 (1947) for example]. Generally, the hearing opens with testimony by an employee of the Food Standards Committee of the Food and Drug Administration who tells how the products under consideration are made, how he thinks they should be made, what, if anything, is wrong with the present practices and then states that, in his opinion, such and such standards should be promulgated to promote honesty and fair dealing in the interest of consumers. There may be several government witnesses; then any one else may ask to testify and, if qualified, he may present evidence and submit to cross-examination by the government lawyer, or, for that matter, by others present. On the whole, a spirit of informality prevails and strict rules of evidence are not observed. Hearsay and unqualified opinion is generally, if not always, admitted.

Some time after the hearing has been concluded a "Tentative Order" appears in the Federal Register. In this is a statement somewhat as follows [Fed. Reg. 12, 69 (1947)]:

> "It is proposed that, by virtue of authority vested in the Federal Security Administrator by the provisions of the Food, Drug and Cosmetic Act . . . and upon the basis of substantial evidence of record at the public hearing held pursuant to the notice issued on February 11, 1946, the following order be made:
>
> "Findings of Fact . . . "

Then follows a number of statements made during the public hearing. While they are entitled "Findings of Fact" they may not all be facts. They are merely statements made by witnesses which, in the main, support the conclusions that appear after the Findings of Fact. In one case the conclusion reads as follows (Fed. Reg. *ibid.*, p. 72):

> "Conclusion: On the basis of the evidence of record and the foregoing findings of fact, it is concluded that the following regulations . . . will promote honesty and fair dealing in the interest of consumers.
>
> "It is ordered, that there be established definitions and standards of identity as follows:"

Then follows the standards.

Anyone who appeared at the original hearing may, within twenty days, file written exceptions to the order. After consideration of any exceptions that may have been filed, a final order appears which becomes effective within 90 days unless an appeal to the Circuit Court is taken.

Note that the Administrator proposes the standards, his employees, along with other witnesses, present evidence, the judge or hearing officer, who determines the facts, is appointed and employed by the Administrator, and the order of the Administrator has all the effect of law. Judge Curtis L. Waller of the Fifth Circuit Court of Appeals in the Amer. Bar Assoc. J., Dec. 1945, said:

> "The concept that any part of the judicial power of the United States could be constitutionally vested in a tribunal, that is within itself accuser, witness, judge and jury is rather disturbing, and the manner in which some of them have performed must shock some of those individuals who have plugged so consistently in support of the thesis of bureaucratic infallibility."

Further, Judge Waller, said:

> "Give me the right to fix the facts and you may have the right to declare the law. If ascertaining the truth is not the first step in the administration of justice, then I confess that I have no conception of the process. The right to know the truth is an integral and essential attribute that belongs to a court of justice."

Now, of course, it would be assumed that the Administrator, in his findings of fact, would publish facts, both pro and con. It has been noted that sometimes the published "findings of fact" ignore pertinent facts presented by the opposition which were scarcely challenged by the government. An instance can be cited where the favorable testimony of a government witness was quoted as a finding of fact, but his unfavorable comment was not published. In other words, if one reads the findings of fact, the order appears justified, but, if one reads the record, an entirely different conception may develop.

Proponents of the system may admit this objection, but then say, "Well, you have the right to appeal to the court if you don't like the decision of the Administrator." Space does not permit a full answer to this statement but Judge Waller answers it as follows:

> "The findings of these boards and commissions are by statute generally made final and they cannot be set aside upon review by courts if such findings "are supported by evidence," not if supported by the weight of the evidence . . . even though the Court might be thoroughly convinced that the factual findings of the board are the result of bias, prejudice, or even stultification, it cannot set the findings aside except for errors of law, if there is any substantial evidence in the record to support the findings."

THE EFFECT OF STANDARDS

Proponents of standards generally point to the flour standards as an example of what they allege to be their advantages. They fail to call attention to the fact that it was not the adoption of standards that brought about the enrichment of flour, but rather that voluntary action on the part of industry made the adoption of these standards rather simple. Prior to this action 75 to 80% of all family and bakers flour was being enriched on a voluntary basis. Parenthetically, Federal Standards for Enrichment do not compel the miller to enrich. Such compulsory legislation is at state levels.

The advantages of enriched flour are not the elimination of any economic fraud or deception of the public but rather an increase in the vitamin content of the average American dietary. Therefore, such advantages, coming from nutritional additions to the national dietary, are chiefly due to the flour manufacturers and not to any standards of identity which were adopted. Since the flour standards corrected no abuses and came after 80% of the flour was already being enriched on a voluntary basis, one is entitled to ask why the standards were established. Was it to gain favorable publicity for a product which had received some adverse publicity; or, was it to provide a model to be used later by those advocating compulsory enrichment on a state level?

One may believe that it is desirable to attempt to legislate nutritional improvements by administrative edict, but it is questionable that this was the intent of Congress when the 1938 Act was adopted. Mr. J. Thomas Schneider said in this connection [Food, Drug & Cosmetic Law Quarterly 2, 37-8 (1947)]:

> "In the light of the historical development of this enactment there seems to be little room for doubt but that Congress used the words "honesty and fair dealing" in this section in their ordinary sense. This would indicate that the words were used as meaning that the promulgation of standards would be for the purpose of preventing consumers from being defrauded by unfair practices on the part of food manufacturers, such as being furnished a debased substitution or an imitation, whereby they did not get their money's worth. . . . "
>
> "That the promotion of honesty and fair dealing was not intended to mean the promotion of the consumers' health would also seem to be plainly ascertainable from a study of the language of Section 401. Furthermore, it would seem apparent that the establishment of standards was not authorized merely to avoid a general confusion on the part of consumers nor for the purpose of educating them as to their dietary needs. Nowhere in the Hearings does it appear that the Congress considered the public's need for education relative to dietary requirements as constituting a basis for the promotion of honesty and fair dealing. The promotion of health and the promotion of honesty and fair dealing may have some relationship, yet it is clear they are not the same thing."

It is surprising how many people do not realize that wholesome, nutritious, honestly labelled and fairly advertised foods can be ruled off the market because of standards. The farina case is an example of this. When definitions for enriched flour were adopted, standards for enriched farina were promulgated which required enriched farina to contain thiamin, riboflavin, niacin, and iron with the option of adding calcium and/or Vitamin D. For 10 years prior to this The Quaker Oats Company had been marketing farina enriched with Vitamin D. The product was labeled, "Farina—Enriched with Vitamin D." However, by the definitions promulgated by the Food and Drug Administrator this product was neither farina nor enriched farina.

It was not farina because it contained Vitamin D. It was not enriched farina because it did not contain the required amounts of thiamin, riboflavin, niacin, or iron. The manufacturer appealed to the Circuit Court and was upheld but this decision was reversed by the Supreme Court which said in part:

> "We must reject at the outset the argument earnestly pressed upon us that the statute does not contemplate a regulation excluding a wholesome and beneficial ingredient from a definition and standard of identity of a food. The statutory purpose to fix a definition of identity of an article of food sold under its common or usual name would be defeated if producers were free to add ingredients, however wholesome, which are not within the definition."

The so-called "catsup case" involved somewhat similar considerations. Standards of identity for catsup were promulgated which did not include the use of the preservative, sodium benzoate, as an optional ingredient although this had been common practice for many years. After the publication of this standard Libby, McNeil, and Libby sold a product comprising catsup which conformed in every detail to the standard for that product but included one-tenth of one percent of sodium benzoate. The product was plainly labelled catsup plus preservative so no

consumer could fail to see that sodium benzoate had been added. The product was seized by Food and Drug and the case went to the Circuit Court. Libby argued that catsup plus preservative was not the product for which a standard had been established, namely catsup. It was a case of selling product A mixed with product B and the manufacturer argued that A plus B could not possibly be equal to A. The court upheld the government.

These cases show that where standards of identity have been set the manufacturer must adhere strictly to such standards. Neither additions nor subtractions may be made, no improvement, no modification not included within the standards is permissible even though such improvements or modifications are fully explained on the label. A product of degerminated corn meal plus defatted corn germ would be misbranded if sold as any kind of corn meal. Solvent extracted whole corn meal likewise can not be sold legally as a corn meal.

EFFECTS OF PRESENT POLICY

Corn millers as well as other food manufacturers consider this type of standard to be restrictive. They say these standards discourage progress because ceilings and walls as well as floors are placed around standardized products barring beneficial changes until after the standards have been revised. They believe the present policy of restrictive standards removes much of the incentive for the manufacturer to improve food products for which standards have been promulgated, and therefore discourages industrial research on such products. That this is possible was foreseen by Wilder and Williams who stated [National Research Council, *Bull.* 110, 14 (1944)]:

> "Under a free economy, invention of new, attractive, and wholesome food products should not be stifled by bureaucratic controls. Without legal checks and safeguards it is conceivable that a zealous administrator might carry out such an extensive and detailed program of defining all foods on the market that a new, meritorious product could be promoted only under some fanciful or arbitrarily chosen name which would convey no meaning to the public. To illustrate: the administrator might so define cake that some new but wholesome and appetizing fruit could not be incorporated in a product sold as cake."

Mr. William T. Woodson, a prominent attorney in Chicago, stated on an Institute of Food Technologists panel discussion in March 1946, that:

> "The Administrator is, in my opinion, laying a dead hand on progress in the food industry when he prevents a manufacturer from going beyond a fixed standard to give the public a better product. This should be encouraged, not discouraged . . . the regulations promulgated under the food standards act punishes a food manufacturer for misbranding who has gone beyond his fixed duty in improving his product so that the public is getting a superior food and is being benefited by the manufacturer's superior skill and research in improving his product."

The threat of standards has delayed the introduction of new and improved foods, and will prevent the introduction of certain improved foods unless someone takes the time and money necessary to get certain restrictive standards amended or removed. It is no secret that state legislation and the threat of federal standards delayed the marketing of a vitamin fortified corn meal and corn grits for several years. Degerminated corn meal could be improved nutritionally by the addition of defatted corn germ but this addition is not permitted under present standards. Whole germ can be added but this affects the keeping quality adversely, whereas

defatted germ is stable under storage. Although testimony was presented by industry during public hearings on corn standards that the nutritional value of corn could be improved by protein enrichment of corn with defatted corn germ, soya flour, or dried skim milk; although the work of Elvehjem, showing a relationship between tryptophane and niacin, was cited, no reference to any of this testimony was included in the "Findings of Fact" [Fed. Reg. 12, 3107-10 (1947)] nor was any provision for such improvements included in the standards.

This failure on the part of the Administrator to include within the standards, products of merit, is not unique. A process for preserving after canning, the attractive green color characteristic of high quality fresh green peas involved the use of very small amounts of sodium carbonate, calcium oxide and magnesium oxide. Although the process was practicable and produced an excellent product, the original standards for canned peas did not permit its use. It cost the sponsor of the process many tens of thousands of dollars to get the standards amended so the process could be used.

Another manufacturer wished to can asparagus using natural asparagus juice instead of water as required by the standards. It cost him many thousands of dollars to get the standards amended to permit him to do what any housewife or home economist would have approved at the first suggestion.

A very simple example of how standards may prevent even a simple improvement in a food is the case of "dusty farina." A manufacturer making enriched farina containing the optional ingredient, calcium, found his product to be somewhat dusty due to the fineness of the calcium salt. This difficulty could be overcome by the addition of a small amount of vegetable oil. There was no question of edibility or suitability. Everyone consulted agreed that the addition of oil should reduce the dustiness and might result in keeping the mineral more evenly dispersed throughout the cereal. This would be an improvement. One thing stood in the way—standards of identity. Without a public hearing and without amended standards the improvement could not be made.

It is believed that standardization of any food reduces the chance for any manufacturer, large or small, to introduce any improvement in the food and capture the market. If an improvement is conceived by a little fellow, he will probably be unable to afford the cost necessary to get the standards amended. If it is a large manufacturer, he often feels that there is no reason to spend the money because he would merely educate his competitors and gain no advantage. Continuation of the present policy in connection with food standards will thus promote monopoly and discourage competition. Small manufacturers often get their start because they have a new or novel idea upon which they capitalize and develop a substantial business before their larger competitors know what has happened.

Standards as they are now promulgated contain floors, ceilings and surrounding walls within which all manufacturers of included products can operate without fear of any competitor gaining an advantage through improvements and research developments. The policy now practiced produces restrictive standards which can be met by the majority of the industries affected. They are not high, nor are they low. The large manufacturer can generally meet them without much effort. If it costs the small producer too much to become equipped to meet them, he must go out of business.

If the foregoing is true then a premium is placed on mediocrity of performance and ingenuity and initiative are discouraged.

Robert R. Mickus, a food consultant of Chicago, had this to say during an Institute of Food Technologists panel discussion in March 1946:

> "I conclude that Federal Standards of Identity for foods do not favor the small manufacturers or encourage their entrance into the food field. They restrict his sphere of operations and place an additional burden on his activities far in excess of the benefits he derives from them. Governmental paternalism is undesirable when it does not sustain progress."

It seems apparent to many that the present trend toward food standards if continued will within a few years shackle the entire food industry. No important manufactured food can hope to be exempt. Floors, ceilings and walls will be thrown around all such products. The danger to nutritional improvement, to industrial food research, to food technologists is real.

REMEDIES

Every one sincerely favoring honesty and fair dealing in the interest of consumers and manufacturers should support such changes in present policies as will promote these objectives. The following suggestions are offered in the belief that they are constructive and if adopted would greatly benefit the public as well as the food industry.

1. Adopt the policy that standards shall be for the purpose of preventing economic frauds or deception of the public.

2. Where standards are necessary to prevent economic fraud or deception of the consumer, let those standards include minimum nutritional or economic values without prohibitions as to improvements.

3. At the public hearing only testimony that meets the legal rules of evidence should be admitted. Hearsay, conjecture, and opinions of unqualified persons should be excluded. "Expertness" should not be substituted for facts.

4. The standards, and the findings of fact upon which they are based, should be supported by the preponderance of the evidence presented at the hearing. The Administrator should not be permitted to ignore facts.

5. Power should be given the courts to set aside any standard that is not supported by a preponderance of the evidence on the record taken as a whole.

News of the Institute

PROGRAM

Seventh Annual Food Conference, 1947, Boston, Mass.

SUNDAY, JUNE 1 — HOTEL STATLER

Council Meeting . . . . . 9:00 A. M.

Registration . . . . . 4:00-9:00 P. M.

General Session . . . . . 7:30 P. M.
Chairman: Robert S. Scull

Symposium—Potential Applications of Colloidal Chemistry in Food Processing

Discussion Leader:
Dr. Ernst Hauser, Professor
Massachusetts Institute of Technology

MONDAY A. M., JUNE 2
General Session, Hotel Statler

Call to Order . . . . . 9:30 A. M.
President E. H. Harvey presiding

Address: President E. H. Harvey

General Announcements . . . . . 9:50 A. M.
S. C. Prescott, Chairman
New England Section Arrangements Committee

Address: Relation of Food Technology to Company Management . 10:00 A. M.
Philip W. Pillsbury, President
Pillsbury Mills, Inc., Minneapolis, Minn.

Address: Relation of Technology to Sound Company Financing . . 10:35 A. M.
Lawrence F. Whittemore, President
Federal Reserve Bank of Boston, Boston, Mass.

Address: Good Human Relations Pay Dividends . . . . . 11:10 A. M.
C. P. McCormick, President
McCormick & Co., Baltimore, Md.

MONDAY NOON
General Session, Hotel Statler
President E. H. Harvey presiding

Luncheon . . . . . 12:15 P. M.

Presentation: Achievement Award . . . . . 1:15 P. M.
L. V. Burton, Editor
Food Industries, New York, N. Y.
B. E. Proctor, Chairman of Award Jury
Massachusetts Institute of Technology, Cambridge, Mass.

Acceptance: Achievement Award . . . . . 1:30 P. M.

MONDAY P. M., JUNE 2

General Session, Massachusetts Institute of Technology

Vice President H. C. Diehl presiding

Call to Order . . . . . 2:30 P. M.

Address: Organization and Management of Research and Development
Louis E. McCauley, Vice President
Armour and Company, Chicago, Ill.

Address: Methods of Obtaining Costs on Research Projects . . . 3:15 P. M.
Thomas M. Rector, Vice President
General Foods Corp., New York, N. Y.

Address: Value of Industrial Research Institutes to Food Technology 4:00 P. M.
W. L. Campbell, Professor of Food Technology
Massachusetts Institute of Technology, Cambridge, Mass.

Dedication of Prescott Laboratories . . . . . 4:30 P. M.

Inspection of M. I. T. Laboratories . . . . . 5:30 P. M.

Banquet Session, Hotel Statler

7:00 P. M.

President E. H. Harvey presiding

Presentation: Nicolas Appert Medal Award . . . . . 8:00 P. M.
C. C. Ziegler, Chairman, Chicago Section

Acceptance: Charles Olin Ball . . . . . 8:10 P. M.
Research Laboratories, Owens-Illinois Glass Co., Toledo, Ohio

Address . . . . . 8:30 P. M.

TUESDAY A. M., JUNE 3

General Session, Hotel Statler

Chairman: George Garnatz

Subject: Sanitation in Food Handling and Storage

Call to Order . . . . . 9:00 A. M.

1. The Food Industry Needs Self Control
H. C. Diehl, Director and Secretary
Refrigeration Research Foundation, Berkeley, Calif.
2. Recent Developments in Transportation and Storage of Raw Materials for Processing . . . . . 9:45 A. M.
W. T. Pentzer
Division of Fruit and Vegetable Crops and Diseases
U. S. Department of Agriculture, Fresno, Calif.
3. Modern Methods of Treating and Packing Fresh Foods for Rapid Transport . . . . . 10:30 A. M.
4. What World War II Revealed in Transportation and Storage of Processed Foods . . . . . 11:15 A. M.
Hatton B. Rogers, Jr., Director of Quality Control
Phillips Packing Co., Cambridge, Md.

Lunch . . . . . 12:15 P. M.

TUESDAY P. M., JUNE 3

General Session, Hotel Statler

Chairman: J. L. Hileman

Subject: Processing Sanitation

Call to Order . . . . . 2:00 P. M.

1. Proper Specifications for and Usage of Stainless Steels to Achieve Sanitation and Corrosion Resistance in Food Processing.
   Richard C. Cunningham, Chief Metallurgist
   Industrial Steels, Inc., Cambridge, Mass.

2. Detergents for Food Plants and Methods for Their Evaluation . 2:45 P. M.
   H. A. Trebler
   Research Laboratories
   National Dairy Products Corp., Baltimore, Md.

3. How to Improve Sanitary Control Trough Equipment Design
   a. Dairy Products & Liquid Foods . . . . . 3:30 P. M.
      E. H. Parfitt, Division of Sanitary Standards
      Evaporated Milk Association, Chicago, Ill.
   b. Meats and Meat Products . . . . . 4:00 P. M.
      H. E. Kingman, Jr., General Superintendent's Office
      Wilson & Co., Chicago, Ill.

4. How California Instituted Sanitary Control in Food Plants . 4:30 P. M.
   Karl F. Meyer
   George Williams Hooper Foundation
   University of California Medical Center, San Francisco, Calif.

Business Session—President E. H. Harvey presiding . . . . . 5:00 P. M.

Evening Program

Boston Symphony Orchestra Pop Concert . . . . . 8:00 P. M.

WEDNESDAY A. M., JUNE 4

Technical Sessions, Hotel Statler

Session I—Refrigeration and Freezing

Chairman: Clifford F. Evers

1. Description and Evaluation of Freezing Systems . . . . . 9:00 A. M.
   R. C. Poole, Research and Development Engineer
   Birds Eye-Snider Division, General Foods, Corp., New York, N. Y.

2. Factors in Bacteriological Deterioration of Frozen Foods . . 9:45 A. M.
   Charles H. Harp, Food and Container Research Institute
   U. S. A. Quartermaster Corps., Chicago, Ill.

3. Preparation of Foods for Freezing . . . . . 10:30 A. M.
   Alvin I. Nelson, Technical Supervisor
   Frozen Fruit and Vegetable Dept.
   Loudon Manufacturing Co., Terre Haute, Ind.

4. Sanitation Technics for Frozen Food Plants . . . . . 11:15 A. M.
Barbara Louise Hutchings, College of Home Economics
Drexel Institute of Technology, Philadelphia, Pa.
Walter Lord Obold, Professor, Bacteriological Sciences
Drexel Institute of Technology, Philadelphia, Pa.

Session II—Problems in Fish Technology

Chairman: A. H. Warth

1. Use of Bacterio-Static Agents in Fish Handling and Processing 9:00 A. M.
Cecil G. Dunn, Department of Food Technology
Massachusetts Institute of Technology, Cambridge, Mass.

2. Mechanism of Spoilage in Sea Foods . . . . . 9:45 A. M.
Carl R. Fellers, Department of Food Technology
Massachusetts State College, Amherst, Mass.

3. Practical Technics in Preservation of Fish and Fish Products 10:30 A. M.
Hugo W. Nilson and Norman D. Jarvis, Fishery Technological Laboratory
Fish and Wildlife Service, College Park, Md.

4. Recent Developments in Fish By-Products . . . . . 11:15 A. M.
H. L. A. Tarr
Fisheries Research Board of Canada, Vancouver, B. C.

Session III—Submitted Research Papers

Chairman: J. J. R. Bristow

1. Bacteriology of Food Packaging Materials . . . . . 9:00 A. M.
Louis C. Barail
United States Testing Co., Hoboken, N. J.

2. Evaluation of Foam Producing Agents
Ralph M. Bohn, Division of Food Products Research and Development
Archer Daniels Midland Co., Minneapolis, Minn.

3. Storage Characteristics of Frozen Orange Juice Concentrates
R. H. Cotton, Florida Research Laboratory
National Research Corp., Plymouth, Fla.
W. R. Roy, Chief Chemist
Vacuum Foods Corp., Plymouth, Fla.

4. Removal of Sugar From Raw Egg-White by Yeast Before Drying
J. C. Ayres, Y. H. Yare, W. S. Ogilvy, R. W. Kline and G. F. Stewart
Bacteriology Section, Iowa Agricultural Experiment Station, Ames, Iowa

WEDNESDAY P. M., JUNE 4

Boat Excursion to Gloucester . . . . . 2:00 P. M.
Inspection of Gloucester Fisheries . . . . . 4:30 P. M.
Clam Bake and Lobster Feed at Birdseye Estate . . . . . 6:00 P. M.

THURSDAY, JUNE 5

Food Plant Trips . . . . . All day

News of Regional Sections

It is hoped that the advent of this new but long advocated section of Food Technology will fill a serious need which has existed since the establishment of the I. F. T. How successfully this objective may be attained will depend in part on the news items sent in by section secretaries and individual members and on the amount of space that can be allocated for this purpose.

We should much prefer to have the same news item sent in by three members rather than to miss a potential notice of importance. So let us know what our members and friends are doing, when they change jobs, what honors and promotions they are getting, and an effort will be made to keep every I. F. T. man informed regarding the latest developments in every sector.

With 2500 corresponding secretaries (for you are all elected), we should get better acquainted and better posted, both professionally and personally. Please send all news items to Dr. Bernard E. Proctor.

NORTHEAST SECTION

The latest plans formulated for the 1947 I. F. T. Conference to be held in Boston, Massachusetts, in June include the following:

Symposium on Colloidal Aspects of Foods. Sunday evening, June 1.

Technical Programs. All day Monday and Tuesday, and also Wednesday morning, June 2, 3, and 4. An outstanding array of management and technical talent has been assembled by "State" and his committee.

Food Plant Trips. Thursday morning and afternoon, June 5. A number of interesting local food plants will act as hosts.

Banquet and Presentation of Nicolas Appert Medal. Monday evening, June 2. Hotel Statler.

Pops Concert by Boston Symphony Orchestra at Symphony Hall, Boston. All members will be the guests of the local section. Tuesday evening, June 3.

Boat Excursion to Gloucester. Wednesday afternoon and evening, June 4. A steamboat has been chartered for a trip by all visitors to historic Gloucester, where the traditional New England clambake will be served. The return to Boston in the evening will also be by boat. A few hotel rooms in Gloucester will be reserved for any who may wish to remain in Gloucester overnight for sight-seeing or plant visits the following day.

THIS WILL BE THE FINEST I. F. T. MEETING THAT HAS EVER BEEN PLANNED. NEITHER YOU NOR YOUR WIFE CAN AFFORD TO MISS IT. RESERVATION REQUESTS SHOULD BE RETURNED PROMPTLY TO INSURE FACILITIES FOR YOU ON YOUR ARRIVAL. PLEASE DO IT NOW! REMEMBER THESE FOUR DAYS ARE THE FAMOUS "SPRINGTIME IN NEW ENGLAND".

CHICAGO SECTION

Papers presented recently at the Chicago Section were as follows:

February 17. "Theory of Quality Control by Statistical Methods", by Prof. Lloyd A. Knowler (State University of Iowa).

February 17. "Application of Quality Control by Statistical Methods", by Dr. Marjorie L. Sutherland (Libby, McNeill & Libby).

March 17. "The Role of Phosphates in Food Processing; Their Preparation and Use", by Mr. Paul Logue (Phosphate Division, Monsanto Chemical Company, St. Louis, Missouri).

The Chicago Section takes pleasure in announcing that the jury has selected Dr. C. Olin Ball as the 1947 Nicolas Appert Medalist. Dr. Ball has been associated with the laboratories of the National Canners Association, the American Can Company, the Owens-Illinois Can Company, and the Owens-Illinois Glass Company. He has done outstanding work in food technology and is the author of fundamental research publications on thermal sterilization of canned foods and canning technology. He has been active in I. F. T. and is at present the editor of Food Technology. The award will be made at the 1947 conference in Boston.

NORTHERN CALIFORNIA SECTION

At the February 20 meeting of the Northern California Section the following talks were given:

"Food Plant Wastes", by Dr. Reese Vaughn, University of California.
"The 1947 National Meeting in Boston", by Dr. S. C. Prescott.
"Winery Stillage Disposal", by Mr. Leo Berti.

Future meetings are scheduled for April 24, June 19, August 21, October 23 (Joint Meeting with Southern California Section and Ladies' Night), December 4 (Annual Meeting).

The Executive Committee met on January 30, to name 1947 committees and to set meeting dates and places. The following applications for Section membership were approved: Dr. Philip Meads, T. R. Gillette, Paul Hile, Gilbert Pitman, A. R. Volkmuth. Associate membership was offered to Joseph Simon.

The Northern California Section has issued the first number of a news letter entitled "The I. F. T. Hornblower", with the following staff: Editor, Walter Richert; Circulation Manager, Ernest E. Jacobs; Adviser, Emil M. Mark; Editorial Staff, Fred Morrison, Lloyd Hansburger, A. K. Balls, and Tom Bruce. A publication schedule of six issues per year is planned, and the approximate publication dates will be three weeks before each meeting. Congratulations are in order for the establishment of a section news letter!

SOUTHERN CALIFORNIA SECTION

The following program is scheduled for two of the meetings of the Southern California Section:

March 26. Conference on Frozen Foods, led by Mr. James S. Lawless.

June 20. All day meeting of the Los Angeles Food Industry at the campus of the University of California, Los Angeles. The Los Angeles Food Industry has been invited to attend a conference on "Sanitation and Waste Disposal Problems". A luncheon and evening banquet are being provided.

Meetings are also scheduled for April 23 and May 21.

Mr. Roy Hagen and Mr. Tony Lorenz have been appointed as co-chairmen in charge of the Southern California Section's part of the national meeting scheduled for 1949 in California.

Visitors from other sections are cordially invited to attend the meetings of the Southern California Section.

NEW YORK SECTION

The New York Section has held four monthly meetings to date for the 1946-1947 season. At these meetings the following papers were presented:

October 16. "Taste-Testing Techniques", by Dr. W. Franklin Dove.
November 20. "Sanitation in Food Plants", by Mr. Milton E. Parker.

January 15. "What Management Should Know about Research and Development in Industry", by Mr. Thomas Rector.

February 19. "Recent Developments in Pectin Chemistry", by Dr. Z. I. Kertesz.

Active interest in food technology has been shown by members of this section. The average attendance this year has been approximately one hundred. Mr. Rector's talk was of particular interest to food technologists, for following the presentation of his paper before the New York Section, he was asked to present this subject to the Boston Section and in the near future will present the same talk to the Maryland Section. The New York Section was fortunate in having Mr. Rector agree to prepare a transcript of his talk for distribution to the members, so that they may have an opportunity to study and digest the material presented.

The Executive Committee of the New York Section has approved the establishment of a Section Policy Committee, composed of the three Section Councilors and the Chairman of the New York Section as chairman of this committee. It is anticipated that this committee will aid the national organization in formulating policies that have the approval and support of the members of the Section.

Meetings of the New York Section are held regularly on the third Wednesday of every month at the Building Trades Employers Association Building, 2 Park Avenue, scheduled at 6:30 P. M. Visitors from other Sections are welcomed at these meetings. The April meeting is scheduled for April 9, so that there will be no conflict with the Spring A. C. S. Meeting.

WESTERN NEW YORK SECTION

Dr. G. J. Hucker and Dr. Frank A. Lee, of the Western New York Section, gave talks to the Philadelphia Section of I. F. T. on February 13, at Becks-on-the-Boulevard. Dr. Hucker presented the charter to the Philadelphia Section and spoke on the organization and development of the Institute. Dr. Lee talked on "The Freezing Preservation of Foods". These same talks were repeated at the meeting of the Baltimore Section on February 14.

ST. LOUIS SECTION

In January, Mr. H. C. Schaefer, Manager of the Nutrition Research Department of Ralston-Purina Company, spoke to the St. Louis Section on "The Relationship of the Feed Industry to the Food Industry", and Mr. John T. Knowles, Vice-President and Manager of the general laboratories of Libby, McNeil and Libby, spoke on "Technical Headaches in Developing a New Food Product". On March 24, Mr. J. Carl Dawson, of J. Carl Dawson and Associates, spoke on "Industrial Sanitation".

PUGET SOUND SECTION

The Puget Sound Section is the newest of the twelve regional sections of I. F. T. and was authorized by the Council on September 15, 1946. Starting with six members in this area about two years ago, the membership has been increased to approximately 70 members of all categories at the present time. The present officers of the section, in addition to the chairman and secretary (mentioned in the list of the Regional Sections) are: Ray W. Clough, treasurer; Maurice E. Stansby and C. E. Palmer, executive committee.

The last meeting, one of the most interesting held thus far, took place on Jenuary 6. E. A. Heiss of Wallace and Tiernan Company and J. E. Hall of Pictsweet Foods discussed "The Application of In-Plant Breakpoint Chlorination in the Control of Microorganisms in Food Processing Plants". These two men have been responsible, in large part, for the application of this new concept in chlorination

to sanitation problems in food processing plants. In cooperation with Dr. Ira Somers of the National Canners Association, they have carried out large-scale experiments in several freezing and canning plants in Washington during the last two seasons.

LIST OF REGIONAL SECTIONS, WITH NAMES AND ADDRESSES OF CHAIRMEN AND SECRETARIES

CHICAGO:

Chairman: Mr. C. C. Zeigler, Swift and Company, Union Stock Yards, Chicago, Ill.
Secretary: Dr. John M. Jackson, Research Division, American Can Company, Maywood, Ill.

NORTHERN CALIFORNIA:

Chairman: Dr. Emil M. Mrak, Food Technology Department, University of California. Berkeley, Calif.
Secretary: Mr. Ernest E. Jacobs, Lyons-Magnus Co., Inc., 2545 16th St., San Francisco, Calif.

NORTHEAST:

Chairman: Dr. A. C. Fay, H. P. Hood & Sons, 500 Rutherford Ave., Boston 29, Mass.
Secretary: Mr. J. J. Austin, Dewey & Almy Chemical Co., 62 Whittemore Ave., Cambridge, Mass.

SOUTHERN CALIFORNIA:

Chairman: Mr. William C. Platt, Bireley's, Inc., Hollywood, Calif.
Secretary: Mr. Louis B. Rockland, Department of Chemistry, University of California, Los Angeles 24, Calif.

ST. LOUIS:

Chairman: Mr. E. H. Parks, Crown Can Company, St. Louis, Mo.
Secretary: Miss Mary B. Scott, Ralston Purina Co., St. Louis, Mo.

NEW YORK:

Chairman: Mr. John H. Nair, Continental Foods, Inc., 1500 Hudson St., Hoboken, N. J.
Secretary: Mr. Robert F. Light, The Fleischmann Laboratories, 810 Grand Concourse, New York 51, N. Y.

FLORIDA:

Chairman: Dr. R. D. Gerwe, Food Machinery Corp., Dunedin, Florida.
Secretary: Dr. M. K. Veldhuis, Citrus Products Station, Winter Haven, Florida.

WESTERN NEW YORK:

Chairman: Dr. W. J. Hahn, Beech-Nut Packing Co., Rochester, N. Y.
Secretary: Dr. Frank A. Lee, Division of Chemistry, New York State Agricultural Experiment Station, Geneva, N. Y.

GREAT LAKES:

Chairman: Dr. C. O. Ball, Owens-Illinois Glass Co., P. O. Box 1035-36, Toledo 1, Ohio.
Secretary: Mr. R. B. Wakefield, Director of Research, Gerber Products Co., Fremont, Mich.

PHILADELPHIA:

Chairman: Dr. E. F. Kohman, Campbell Soup Co., Camden, N. J.
Secretary: Mr. M. E. Meschter, American Preserve Company, 3rd and Lehigh Ave., Philadelphia, Pa.

MARYLAND:

Chairman: Dr. A. H. Warth, Crown Cork and Seal Co., Baltimore, Md.
Secretary: Dr. S. W. Arenson, Doughnut Corporation of America, Ellicott City, Md.

PUGET SOUND:

Chairman: Mr. W. R. Gailey, Crescent Mfg. Co., Seattle 4, Washington.
Secretary: Mr. Howard C. Douglas, School of Medicine, University of Washington, Seattle 5, Washington.

Current Abstracts for the Food Technologist

ANALYTICAL METHODS

1G. Use of control charts in the analytical laboratory.

WERNIMONT, GRANT. *Ind. and Eng. Chem. Anal. Ed., 18,* 587-592, Oct. 1946.

Control charts are useful in the testing laboratory for comparing the over-all variability of test data with the average variability of small groups of the data, and are simpler to understand than complicated statistical methods of analysis of variance. Operational meaning of control charts depends on the manner in which arbitrary small groups are chosen.

2G. Estimation of sulfur compounds in air.

FEINER B., BURKE, W. J., AND MOSKOWITZ, S. *J. Ind. Hyg. Tox., 28,* 276-277, Nov., 1946.

A brief review of methods for the estimation of sulfur compounds in industrial air is presented. A method for sampling and analysis of onion oil (allyl propyl disulfide) vapor and xylyl mercaptan vapor is described.

3G. Carotene in sweet potatoes determined by new method.

Ind. Eng. Chem., Anal. ed. 18, 557-62; *Food Mat. Equip., 6, 10,* Oct. 1946.

A new method for total beta-carotene determination involves spectrophotometric measurement of purified carotene after extraction by alcohol and purification by a dicalcium phosphate absorption column. 2-2, 4-trimethyl pentane is the solvent for use in spectrophotometric measurements. Data is given on carotene content of various forms of sweet potato.

4G. Testing the quaternary ammoniums.

DUBOIS, A. S. *Soap & San. Chem., 22,* 125-131, Nov. 1946.

Analytical methods for surface active cationic germicides are given. Volumetric and colorimetric reaction with brom phenol blue, with KI-iodine solution, with ferricyamide and iodometric back titration are described and compared. Kjeldahl nitrogen determination with selenium catalyst is a desirable supplementary test.

5G. Measurement and anaylsis of gases in vacuum-packed food containers.

CARTWRIGHT, L. C. *Ind. Eng. Chem., Anal. Ed., 18,* 779-785, Dec. 1946.

An apparatus and method for determining the quantity and composition of gases in vacuum-packed and gas-packed food containers are described. The method is applicable to both large and small containers, flexible, semirigid, or rigid. Gas contents as small as 1 cc. may be measured and analyzed with fair accuracy, and gas contents of 5 cc. or more permit accuracy of the order of ± 5% or better. Results obtained on a number of vacuum-packed foods, particularly coffee and dry whole milk, are presented, and application of the method to detection of leakage, determination of oxygen and nitrogen permeabilities of packaging materials, and determination of true densities of dry foods is described.

BACTERIOLOGY

6G. Antisepsis and ionization of sodium fluoride.

ROBERTS, M. H. AND RAHN, O. *J. Bact., 52,* 612-613, Nov. 1946.

Even in a 2% solution sodium fluoride has no appreciable bactericidal power. Bacteriostatic power depends on the undissociated fraction of the molecules. In neutral solution efficiency is increased by NaCl.

7G. The production of an antifungal antibiotic by streptomyces griseus.

WHIFFEN, A. J., BOHONOS, N. AND EMERSON, R. L. *J. Bact., 52,* 610-611, Nov. 1946.

It appears that in addition to streptomycin which is effective against various bacteria, streptomyces griseus may also produce an antifungal agent.

8G. Antibiotic activity of some crude plant juices.

LITTLE, J. E. AND GRUBAUGH, K. K. *J. Bact., 52,* 587-591, Nov. 1946.

Juices from several varieties of beans, corn, cabbage, mustard, cucumber, tomatoes and cauliflower were tested against four human pathogens and seven plant pathogens. Only corn, cucumber, wild mustard, and cabbage showed any activity against bacterial plant pathogens while the juice of corn and tomatoes was detrimental to plant pathogenic fusaria. Additional work is being done.

9G. Brewer's yeast grown with more vitamins.

Sci. N. L., 50, 360, Dec. 7, 1946.

Increase by at least 50% in the vitamin contents of brewer's yeast by keeping it on a limited food supply and at relatively low temperature for a week or more is claimed by Ben Maizel of Chicago in patent 2,411,445, assigned to the Vico Products Company.

10G. Characteristics of lactic acid bacteria from commercial cucumber fermentations.

ETCHELLS, J. L. AND JONES, I. D. *J. Bact., 52,* 593-599, Nov. 1946.

Identification studies on 49 cultures of lactic acid bacteria are reported.

11G. Bacteriological studies relating to thermal processing of canned meats. IV. Viability of spores of a putrefactive anaerobic bacterium in canned meat after prolonged incubation.

GROSS, C. E., VINTON, C. AND MARTIN, S. *Food. Res., 11,* 399-404, Sept.-Oct. 1946.

The effectiveness of inhibition of viable spores of anaerobes in canned meats increased with an increased percentage of salt. The effect of nitrate and nitrite was indefinite and negligible compared with the effect of 3½% salt. Dormancy of viable spores was evident at processing levels approaching destruction even in the absence of secondary inhibiters, such as salt.

12G. Bacteriological studies relating to thermal processing of canned meats. V. Characteristics of putrefactive anaerobe used in thermal resistance studies.

GROSS, C. E., VINTON, C. AND STUMBO, C. R., *Food Res., 11,* 405-410, Sept.-Oct. 1946.

Putrefactive anaerobes S_3 and 9X isolated as the causative agents in spoilage of canned meats and S_3 used as a test organism in this investigation are shown to be culturally and serologically identical with P.A. 3679.

Further, S_3, 9X and P.A. 3679 are shown to be culturally and serologically distinct from a strain of Cl. sporogenes (Spray). The morphological and cultural characteristics of S_3, 9X and P.A. 3679 are described.

13G. Bacteriological studies relating to thermal processing of canned meats. VI. Thermal death-time curve for spores of test putrefactive anaerobe in meat.

GROSS, C. E., VINTON, C. AND STUMBO, C. R. *Food Res., 11,* 411-418, Sept.-Oct. 1946.

Data for graphical interpretations are presented for the rate of heat penetration in meat, the thermal death time, the "Z" value for the thermal death-time curve, and the effect of the concentration of the spores present upon the thermal death-time. The putrefactive anaerobe used in this study was S_3 (PA 3679).

ENGINEERING AND PLANT EQUIPMENT

14G. Some considerations in the control of continuous processes.

FROST, H. C. *Instruments, 19,* 589-595, Oct. 1946.

The instrumentation of a hypothetical process is described and the necessary conditions to determine the type instrument or controller are outlined for each step in the process. The process control of flow, pH, temperature and density are described.

15G. Materials of construction. II. Choice for food-processing plant.

BUTCHER, C. H. *Food, 15,* 327-328, Dec. 1946.

The importance of choosing the proper types of materials for processing equipment is discussed. The adaptability of such metals as copper, nickel and aluminum and certain plastic linings for the processing of various types of food is considered.

16G. Statistical control of the production process.

WOOD, A. M. *Food Ind., 18,* 104-106, Sept. 1946.

Control charts assist quality control engineer in deciding what has gone wrong with the process or what may go wrong with it.

17G. New devices improve cleaning and effect economies.

PERRY, J. R. *Food Ind., 18,* 74-78, Oct. 1946.

Developed for use in dairies, devices included nozzle which delivers flat blade of water, a brush in which cleaning solution flows through the handle, mechanisms for cleaning sanitary pipe and fittings.

18G. Fundamental factors in corrosion control.

UHLIG, H. H. *Chem. Eng. News, 24,* 3154-3158, Dec. 10, 1946.

The mechanism of corrosion reactions is given. Various types of protective actions are described together with illustrations of their use and reasons why they work.

19G. Utilization of cooling towers in the food industries.

SIMONS, E. *Food Ind., 18,* 92-96, Sept. 1946.

Methods for evaluating the savings effected by the use of cooling towers, especially where water is used for condensing or cooling cans, are given.

20G. New spray dryer pilot plant.

Chem. Ind., 59, 1005, Dec. 1946.

Research spray dryer of the Swenson Evaporator Company at Harvey, Ill., has a complete system built around a drying chamber 14 feet in diameter. Three other firms, Bowen Engineering, Inc., Western Precipitation Corp., and the Instant Drying Corp., also have test equipment ranging from laboratory units of 2.5 and 4.0 feet diameter, to commercial tests dryers 18 and 20 feet in diameter.

21G. Rotating pan-type mixer.

Food Mat. Equip., 6, 12, Sept. 1946.

This mixer may be used for mixing, blending, coating, coloring, tumbling, and polishing. The tilted pan is motor rotated at constant or variable speed, with or without mixing blades. Tilting range is 135°. It is available in sizes up to 2500 lbs. (50 cu. ft.).

22G. Electronic heating conference.

Electronics, 19, 184-190, Nov. 1946.

In a discussion on radio-frequency treatment of foods experimental data was presented to show a lethal effect exclusive of heat on E. coli in the absence of electrolytes. The presence of only a few hundreds of one percent of Na Cl prevented such action, however. Current work conducted in the microbiological laboratory of the Univ. of S. California may indicate that there is an r-f-effect on microorganisms beyond the purely thermal one, and that there is a specific frequency for each organism or group seems probable.

23G. Heat and material exchange on drying of wet material.

KIRSCHBAUM, E. AND JIENZLE, K., Oct. 1940. *PB 32252 Bibl. Sci. Ind Reports, 2, 789,* Sept. 13, 1946.

The evaporation of water and ethyl alcohol in air is studied. For the process of drying the change of state of the air along the surface of evaporation as well as the heat transmission—and evaporated values are determined. Evaporation took place from the inner surface of Kieselguhr filter stones which had the form of hollow cylinders and were impregnated on the outside with liquid to be evaporated. These filter stones served as the "wet material".

24G. Automatic vacuum-detecting machine for high-speed lines.

Glass Packer, 25, 882-884, Nov. 1946.

This machine brings the closure in a vacuum jar into contact with a diaphram which encloses the base of a column of mercury. The weight of the mercury causes the diaphram to conform with the contour of the closure. The height of the mercury column then becomes a measure of the vacuum. The machine automatically rejects low vacuum containers.

25G. New regulators for controlling pressure —air, gas, water.

Laboratory, 16, 68-69, 1946.

Valves described should have many uses in all laboratories for operations where a constant pressure is required.

FOOD PRODUCTS

BAKING AND BAKERY PRODUCTS

26G. A comparative study of soy flours for use in baking. I. Composition and properties of soy flours.

FAULKNER, E. C. AND SIMPSON, J. I. *Food Res., 11,* 447-453, Sept.-Oct. 1946.

Eighteen samples of soy flour from different parts of the United States were compared as to characteristics important in determining baking quality. A tendency for moisture content, weight per unit volume, and water absorption capacity to decrease as the fat content increases was indicated. In addition, the size of the flour particle tends to increase and be somewhat darker in color in the high fat flours.

27G. Mountain-top baking.

Cons. Guide, 12, 16, Dec. 1946.

Important features of altitude cooking in technical terms, with less technical information for home use are given in a collection of "acclimated recipes" recently isued by the Colorado State Experiment Station.

28G. A comparative study of soy flours for use in baking. II. Effect on quality of muffins and cakes.

FAULKNER, E. C. AND SIMPSON, J. I. *Food Res., 11,* 454-459, Sept.-Oct. 1946.

Eighteen samples of soy flour were used in the preparation of various types of muffins and cakes. Some degree of preference seems to have been found for the use of high-fat soy flour in muffins and of minimum-fat soy flour in muffins and of minimum-fat soy flour in angel-food cake.

CANNED FOOD

29G. The nutritive value of canned foods. Changes in the vitamin content of foods during canning.

GUERRANT, N. B., VAVICH, M. G. *et al, J. Nutr., 32,* 435-458, Oct. 1946.

The vitamin content of a number of vegetables was determined before and after can-

ning. The vitamin retention of these vegetables is given.

30G. Catalytic oxidation of ascorbic acid.

HUELIN, F. E. AND STEPHENS, I. M. *Nature, 158,* 703, Nov. 16, 1946.

The catalytic effect of some salts at various pH values on ascorbic acid is briefly described. The results are important in the determination of ascorbic acid in canned foods.

31G. Overcoming the problems in the canning of cheese.

DAHLBERG, A. C. *Canning Tr., 69,* 8, Nov. 11, 1946.

The ordinary salmon can is adaptable for holding 12 ounces of cheese, and the problem of gas formation in the ripening process is solved by limiting gas production to carbon dioxide. In this way there is no mold growth, the cheese cures continuously, but there is no rusting within the can.

COFFEE, TEA, AND COCOA PRODUCTS

32G. A rapid method for the evaluation of the larger particles present in cocoa powders.

MILLER, L. P. *Contrib. Boyce Thompson Inst., 14* 335-340, Oct.-Dec. 1946.

A rapid method for evaluating the coarser particles present in cocoa powder is described. This involves the measurement of the rate of settling of the first ten particles in a 144 cm. tube filled with 95 per cent alcohol. Data are given showing the reproducibility of the method and illustrating the effect of the presence of various percentages of a coarse fraction in a finely ground cocoa. It is also shown that by measuring the time required for various fractions of the powder to settle (with aid of a graduated pipette forming the lower part of the settling tube) the particle diameter corresponding to the 50 per cent point by volume can be determined with the acid of Stokes' Law.

33G. Particle size distribution in cocoa powders.

MILLER, L. P. *Contrib. Boyce Thompson Inst. 14,* 325-334, Oct.-Dec. 1946.

A method is described for the measurement of the size distribution and calculation of various average diameters for cocoa powders. This method is based on the work of Hatch and Hatch and Choate whereby the plotting of the data on logarithmic probability paper results in a straight line from which the geometric mean, Mg, and the standard deviation, σ g, can be determined and other average diameters calculated from these values. A modification giving greater accuracy in the range of the larger particles without physical separation of these particles, which is difficult in the case of cocoa powder, has been introduced.

Particle size evaluation by ordinary screening is inadequate since modern fine cocoas are largely subsieve in size and furthermore sieving is difficult to carry out properly because of the presence of the low-melting cocoa butter.

34G. Air blast nozzle device for enrobers or chocolate coating machines and the like.

TUNLEY, A. A. 2,410,762, Nov. 5, 1946.

Air blast nozzle means for an enrober comprising an air supply duct, a nozzle coupled to the duct and comprising a pair of plates hinged to the duct on spaced transverse axes.

35G. Liquid extract of coffee and the process of extracting and preparing the same.

FREDRICKSON, WALTER S. 2,410,157, Oct. 29, 1946.

The method of preparing an extract of coffee which comprises mixing a quantity of cold water with a quantity of coffee grounds, varying the temperature of the mixture between the temperature of greatest density of water and a lower non-freezing temperature to expand and contract said mixture, then segregating the liquid extract from said coffee grounds; then at successive intervals mixing further quantities of water with said grounds and heating each of said mixtures, each of said mixtures being heated to a higher degree of temperature than the preceding mixture and the extract of each of said mixtures being separated from said grounds after heating before the succeeding quantity of water is added; mixing together all said extracts; and then removing the waxy substances of varying densities from said combined extract.

FATS AND OILS

36G. Examination of 'sese' palm oils.

HUNTER, R. F. AND KRANKENBERGER, R. M. *Biochem. J., 40,* 492-493, 1946.

Examination of samples of selected and commercial samples of 'Sese' oil showed the presence of α, β, and γ -carotenes, lycopene, lutein, and their neo-isomers. In one case, cryptoxanthin was found.

37G. Processes of dewaxing oils.

DONS, E. M. AND MAURO, O. G. 2,410,483, Nov. 5, 1946.

The process of forming approximately uniform wax crystals in the art of dewaxing oils.

37AG. Fats, oils, and oilseeds.

Goss, W. H. Office of Military Government for Germany (U. S.) October 1945. (Fiat final report No. 297)

The Bollmann system of extraction for soybeans is described, along with other methods of soybean extraction.

38G. Process for hydrobleaching glyceride oils.

PATERSON, WILLIAM J. 2,410,102, Oct. 29, 1946.

A process for hydrobleaching glyceride oils to form edible products having a minimum of unsaponifiable components and an improved color and stability comprising treating the oil at a temperature of from 130 to 250° C. with hydrogen under a relatively high pressure in the neighborhood of 100 atmospheres, for a period of time not substantially greater than 60 minutes and in the presence of not substantially more than 0.5% of a catalyst.

39G. Fatty oil desliming process.

BUSH, W. A. AND LASHER, E. A. 2,410,926, Nov. 12, 1946.

The process of de-sliming a fatty oil by mixing into the oil a substantially saturated water solution of a solid acid selected from the group consisting of sulfamic acid, oxalic acid, citric acid, picric acid and maleic acid in an amount sufficient to break the slime dispersion.

40G. Constant pressure oxygen absorption fat stability test (General Foods method).

GILMONT, R., LEVENSON, H. S. AND ELDER, L. W. *Oil & Soap, 23,* 248-52, Aug. 1946; *Fats, Oils and Detergents, 3,* A:340, 1-3, 1946.

Description of a modified Barcroft-Warburg apparatus for the determination of fat stability.

FROZEN FOOD

41G. What's to be done about quality control.

DIEHL, H. C. *Food Freezing, 2,* 74-78, Dec. 1946.

Suggestions for improving quality control in frozen foods are directed toward improvement of field and plant activities.

42G. Principles of refrigeration applied to storage space.

CHRISTENSEN, P. B. *Food Freezing, 2,* 85-87, Dec. 1946.

The second of a series of three articles; the second dealing with the refrigerating capacity of pipes.

43G. Frozen food blanket eliminates need for in-transit refrigeration.

Food Field Rep., 14, 25, Dec. 9, 1946.

A "frozen food blanket," which eliminates the need for in-transit refrigeration, has been developed, and is currently used in air shipping frozen foods. The "blanket" is produced by placing a one-half inch sheet of rock-wool between two sheets of heavy wrapping paper. This is placed crosswise in a corrugated cardboard container, folded over and stapled before the carton is sealed. The resultant box is virtually air tight, preventing the cold air from escaping and the warm air from entering. Experiments have shown that initial temperature is maintained within two degrees for a period of 72 hours. In some cases the frozen products have remained in good condition for as long as five days.

44G. Stored frozen stock produces better preserves.

THOMPSON, H. H., CECIL, S. R., AND WOODROOF, J. G. *Food Ind., 18,* 73-75, Sept. 1946.

Preserves freshly made from frozen stock have better color and flavor than those made from fresh stock and stored at room temperature. This method provides year round operation. Sulphiting yields poor preserves.

45G. An evaluation of frozen food wrapping materials.

MCCOY, D. C., COOK, S. V. AND HAYNER, G. A. *Food Freezing, 2,* 69-72, Dec. 1946.

Laboratory MVT values at 100° F. and 90% relative humidity are not a reliable index of the suitability of materials for wrapping Frozen Foods. The importance of the material being tightly applied to the surface of the meat was proven by this test as shown in former tests. A good material must be flexible enough so that this is possible. Some materials require rather careful handling at low temperatures as they have a tendency to shatter when cold. Additional mechanical protection similar to the stockinette overwrap is needed.

46G. Report on pork shoulders frozen and stored for four years at 0° F.

NICHOLAS, J. E. *Food Freezing, 2,* 90-91, Dec. 1946.

According to the results of these tests, the leanest pork, properly wrapped, may have its storage period prolonged at 0° F. It may be desirable to glaze and then wrap for best results.

47G. Food freezing by immersion in alcohol.

WELLS, E. P. *Food Freezing, 2,* 83, Dec. 1946.

The freezing of food in sealed tin cans by immersion in alcohol makes possible a considerable reduction in freezing time, as compared with air blasting. Since containers, immersed in alcohol, must be pressure tight, the process is limited to the use of tin cans, or to plastic glass, fibre, or other containers which can be made pressure tight.

48G. Quick frozen potatoes give promising results at Rutgers.

New Jersey Agr. Exp. Station. *New Jersey Agr., 28,* 8, May-June 1946.

New Jersey potatoes were boiled, baked, French fried, scalloped and then quick frozen and placed in a freezer locker unit at the station last fall. Some samples were removed from the locker, thawed, and reheated at the end of 10 days, and the rest were given the same treatment four months later. Results from the first taste tests were promising. Further work will be conducted on improving the flavor and texture.

MILK AND DAIRY PRODUCTS

49G. New routine tests in the dairy industry.

DAVIS, J. G. *Chem. Ind., 40,* 362-364, Oct. 5, 1946.

The following tests are described: (1) Sampling. (2) Chemical tests: fat, solids-not-fat, abnormal milk, phosphatase test, freezing-point test, treatment of soured samples, temperature, time of flow. (3) Bacteriological tests: platform tests, routine grading tests, bulk milk, pasteurized and heat treated milks, pathogenic bacteria, physical tests, condensed milk, evaporated milk, cheese, plant sterility, detergents.

50G. Preservation of milk products.

BRUNKHURST, C. 2,412,203, Dec. 10, 1946.

A method of making a frozen whole milk product from which a reconstituted whole milk may be made by adding water.

51G. Method of producing whip.

MINER, A. S. 2,412,629, Dec. 17, 1946.

The method of producing a foamy product, which consists in cooling skimmed milk containing not more than approximately 0.05 to 0.1 part by weight of fat to a temperature close to the freezing point, and then whipping the cooled skimmed milk until a foam results therefrom.

52G. Process for producing dried milk powder.

SHARP, P. F. 2,412,635, Dec. 17, 1946.

A process for the manufacture of powdered milk products from liquid lacteal material, the steps of spraying the material into contact with hot air in a controlled drying chamber, removing the relatively high humidity gas from the chamber, removing powdered product from the bottom of the chamber at an elevated temperature of the order of from 170° F. to 185° F. and having a moisture content of the order of from 3.5 to 5%. Before an appreciable drop in temperature has occurred, subjecting the powder to a relatively low pressure of the order of from 0.25 to 0.10 inch of mercury for the short period of time sufficient to evaporate the moisture content of the powder down to a value of the order of from 1.0 to 2.0%, the evaporation effecting substantial cooling of the powder.

53G. Deterioration on storage of dried skim milk.

HENRY, K. M., KON, S. K. *et al. Nature, 158,* 348-349, Sept. 7, 1946.

A study of the Maillard type reaction which occurs in dried skim milk in the absence of oxygen indicated a critical moisture level of about 3.0% above which the reaction proceeds with comparative rapidity. It increases with increasing moisture content and has a high temperature coefficient. Packaging is recommended at low moisture levels in moisture proof containers.

54G. Inhibiting mold in dairy products.

BAUER, H. F. AND GLABE, E. F. 2,412,596, Dec. 17, 1946.

A dairy product selected from the group consisting of milk, buttermilk, butter, cheese, powdered milk, powdered cream and whey, containing a substantial quantity of a non-toxic, water soluble alkali diacetate, in a quantity effective to inhibit the growth and development of bacteria and mold in the product.

POULTRY AND EGGS

55G. Standards of quality for individual shell eggs.

U. S. D. A. Production and Marketing Adm., *U. S. Egg and Poultry Mag., 52,* 456-457, Nov. 1946.

Revised specifications for official U. S. standards of quality for individual shell eggs and tentative specifications and weight classes for consumer grades of shell eggs will become effective December 1.

56G. An investigation of a source and mode of entry of salmonella organisms in spray-dried whole-egg powder.

SOLOWEY, M., SPAULDING, E. H. AND GORESLINE, H. E. *Food Res., 11,* 380-390, Sept.-Oct. 1946.

Data are presented on the contamination by salmonella of eggs in the original state including shells, shell membranes and meats; of liquid whole eggs at different processing stages and in the final spray-dried whole egg powder.

57G. Thyroid activity and poultry nutrition.

Nutr. Rev., 4, 297-298, Oct. 1946.

A review is presented of contemporary work on the effect of feeding iodinated compounds to chickens. Egg production is enhanced by such feeding. Also the feeding of iodinated compounds such as iodinated casein delay the decline in egg production as the birds age.

SUGARS, STARCHES AND SYRUPS

58G. Sweetening power of sugars compared.

MILLER, W. T. *Food Pack., 27,* 50, Dec. 1946.

Tests made to definitely determine if inverted sucrose is sweeter or less sweet than sucrose. Expert taste panel selected by stringent trials. Results showed no difference in sweetness within a + 10% to —10% range at a sucrose level of 10%. Enzyme inversion used to preclude effect of acid flavor from acid inversion. Carbonated beverage used as test material.

59G. Research finds new levulose process.

SUGAR RESEARCH FOUNDATION. *Sugar, 41,* 34-35, Nov. 1946.

A new method is described whereby levulose is obtained from sucrose by treatment with dilute acid followed by the addition of lime milk which makes a lime levulose solid. This is separated by filtration and suspended in water. Carbon dioxide is passed through the solution to form $CaCO_3$ and a thin levulose syrup which is evaporated and then crystallized by agitation.

60G. Method of making starch conversion syrup.

BROCK, FRANK H. AND SMITH, CLIFFORD E. 2,410,264, Oct. 29, 1946.

In the process of manufacturing a starch conversion syrup which consists in subjecting an aqueous starch suspension to hydrolysis to provide a starch conversion liquor having a dextrose equivalent of between 45-55 per cent, the improvement which comprises subjecting said liquor to dialysis against water through a semi-permeable membrane, and recovering a dialyzate having a dextrose equivalent greater than 55 per cent.

61G. Variable mineral composition of blackstrap molasses.

FORT, C. A. *Sugar, 41,* 36-37, Nov. 1946.

Data are given on the results of analyses of nine Louisiana and one Cuban blackstrap molasses samples.

VEGETABLES

62G. Vegetable washer.

SUELFLOW, A. G. AND HANSEN, G. I. 2,412,430, Dec. 10, 1946.

A vegetable washing machine having a casing provided with a support adapted for mounting upon a water tank, comprising stirrups projecting from the side walls of the washing machine casing, horizontally positioned arms slidably mounted in the stirrups, means securing the arms in an adjusted position in the stirrups; jaws at the outer ends of the arms for engagement with one edge of a water tank, and vertically disposed supporting legs adjustably secured to the casing of the washing machine adapted to rest upon the bottom of a water tank.

63G. Apparatus for grading fruits, vegetables, and other products according to size.

BLEEKE, GUSTAVE H. 2,410,147, Oct. 29, 1946.

A grading machine comprising a main frame, a flexible grading belt mounted on the frame and having transverse rows of openings therein varying in size, the openings in each row being adapted to permit the passage of a selected maximum size of product, normally depending gates each having a planar upper surface pivotally adjacent to the openings respectively, an endless carrier mounted below the belt and supporting a plurality of abutments, each of which is adapted to engage the belt and the transverse rows of gates successively and rock them into the belt openings adjacent thereto, said gates being adapted to substantially fill said openings, said travelling abutments also causing the belt to undulate longitudinally.

64G. Vacuum drying of compressed vegetable blocks.

DUNLAP, W. C. *Ind. Eng. Chem., 38,* 1250-1253, Dec. 1946.

Drying of compressed blocks of partially dried potato and carrot by the use of vacuum and radio-frequency heat at 60° C. was compared with drying in a vacuum oven at 60° C. Although the radio-frequency method had definite advantages with respect to speed of drying, the vacuum-oven method produced higher quality. The vacuum oven set at 70° C. appeared to be roughly equivalent, with respect to both speed of drying and quality, to the radio-frequency method at 60° C.

65G. Celery cutter.

BELL, T. J. 2,410,860, Nov. 12, 1946.

In a celery cutter, a boom disposed transversely of a tractor, means pivotally mounting the boom on the tractor, means for moving the boom upwardly on the pivots for lifting the same to inoperative position, or for lowering the same to operative position, a plurality of vertically adjustable cutters disposed on said boom, there being a cutter for each row of celery.

66G. Celery harvesting apparatus.

BELL, T. J. 2,410,861, Nov. 12, 1946.

Celery harvesting appartus comprising a tractor having front and rear transversely disposed draw bars thereon, a plurality of wheeled frames secured to the front draw bar and having a blade projecting laterally from each side of each frame for cutting adjacent rows of celery.

67G. Corn picker.

ROE, A. L. 2,412,358, Dec. 10, 1946.

A corn picking machine comprising an inclined elevator adapted to be mounted for vertical swinging adjustment on one side of a vehicle.

INDUSTRIAL CHEMISTRY

68G. DDT and other insecticides and repellents.

U. S. D. A. Misc. Pub. No. 606, Aug. 1946.

69G. How Antu and 1080 promise better rodent control.

Editorial Staff Report. *Chem. Ind., 59,* 828-829, Nov. 1946.

Use, action, properties of Antu and 1080 discussed.

70G. DDT analysis.

GINSBURG, J. M. *J. Econ. Entomol., 39,* 174-177, (1946); *Soap & San. Chem., 22,* 147, Nov. 1946.

Eight chemical methods for DDT analysis are listed. A chemical method distinctly specific for DDT is needed.

71G. DDT determination.

ILLING, E. T. AND STEPHENSON, W. H. *Analyst, 71,* 310-314, (1946); *Soap & San. Chem., 22,* 147, Nov. 1946.

Two colorimetric methods for the determination of DDT are given.

72G. Some compounds related to the insecticide "DDT" and their effectiveness against mosquito larvae and houseflies.

PRILL, E. A., SYNERHOLM, M. E. AND HARTZELL, A. *Contrib. Boyce Thompson Inst., 14,* 341-353, Oct.-Dec. 1946.

Thirty-two compounds of the "DDT" type are described and compared with respect to their effectiveness against mosquito larvae and houseflies. Among these are several unsymmetrical analogs. Of the analogs of "DDT," only a few alkoxy analogs were found really superior to "DDT" with respect to either knockdown ability or kill when used against houseflies or in their effectiveness against mosquito larvae. From the data, it appears that a compound of the "DDT" type must have certain substituents in the 4,4′ positions in order to have a high degree of activity. The presence of additional substituents in other positions appears to cause a diminution of the activity.

73G. An industrial hygiene survey of an onion dehydrating plant.

FEINER, B., BURKE, W. J. AND BALIFF, J. *J. Ind. Hyg. Tox., 28,* 278-279, Nov. 1946.

Results of an industrial hygiene survey of an onion dehydrating plant are presented. A tentative threshold limit for allyl propyl disulfide is suggested. Methods for control of air borne contaminants in an onion dehydrating plant are briefly outlined.

NUTRITION

74G. Essential fatty acids and human nutrition.

HANSEN, A. E. AND BURR, G. O. *J. Am. Med. Assoc., 132,* 855-859, Dec. 7, 1946.

One of the greatest difficulties in ascertaining the essential nature of certain unsaturated fatty acids in human subjects is attributed to the inability to measure accurately the content and distribution of linoleic and arachidonic acid in the blood and tissues. The author's findings give strong support to the theory that the human organism is unable to synthesize the unsaturated fatty acids which have been found to be essential for some animals. The adaptation of spectroscopic methods to the quantitative measurement of linoleic and arachidonic acids in human serum and tissue promises to aid further studies of the need for the specific function of the essential fatty acids in human nutrition.

75G. Present knowledge of iron and copper in human nutrition.

Nutr. Rev., 4, 291-293, Oct. 1946.

A review is presented of the present knowledge of iron and copper in human nutrition.

76G. QMC wants to know what foods have national appeal. U. S. Quartermaster Corps.

Canner, 103, 34, Nov. 9, 1946.

A survey will be made to determine which food items are acceptable to virtually all people in the U. S., since the Army has learned that staples in one part of the country are unacceptable to men from a different area. The ultimate list will be analyzed for utility, stability, nutritional value and acceptability, and is expected to effect the feeding of the entire nation by improving standards and through economies in preparation and distribution.

77G. Influence of bread on tooth decay.

SCHULERUD, A. *Northw. Miller, 228,* 5a, Dec. 10, 1946.

In relation to caries white bread is not any way more detrimental than wholemeal bread. The only time when possibly wholemeal bread may have an advantage is in making up for certain deficiencies but the addition of vitamins to flour will make this of less importance. There is evidence to show that the combination of bread and sugar has some connection with the development of caries through furthering the growth of the organisms that cause the disease. A well-baked bread, enrichment of the flour through the addition of vitamins, and selection of the correct types of hard bread, should be the contribution of the cereal chemist in the fight against dental caries.

78G. Man to know exact protein requirements.

ROSE, W. C. *Sci. N. L., 50,* 275, Nov. 2, 1946.

In the near future man will be able to set exact protein requirements for men, women, and children on the basis of human needs rather than indirectly from the requirements of rats and other laboratory animals.

79G. The availability of histidine derivatives for growth.

NEUBERGER, A. AND WEBSTER, T. A. *Biochem, J., 40,* 576-582, 1946.

A diet of 18 amino-acids produced in young rats a rate of growth which was similar to that found with a diet containing 8% casein. Omission of histidine led to the loss of weight. The effect of various derivatives of histidine is described.

80G. Chicken high in niacin content.

U. S. Bureau of Animal Industry. *Northeastern Poultryman, 46,* 47, Nov. 1946.

U. S. Bureau of Animal Industry's tests show that the breast of chicken, especially of broilers and fryers, is an excellent source of niacin. The dark meat is superior in the vitamins, riboflavin and thiamin.

81G. The β-amylase of barley.

HOPKINS, R. H., MURRAY, R. H. AND LOCKWOOD, A. R. *Biochem, J., 40,* 507-512, 1946.

The amylase of resting barley grain is mostly β-amylase with a trace of α-amylase. A method of preparation and extraction procedures for β-amylase are described. A discussion of the limit of barley amylase action is given.

82G. B-complex vitamins in meat. I. Thiamin and riboflavin content of raw and cooked pork.

VAIL, G. E. AND WESTERMAN, B. D. *Food Res., 11,* 425-431, Sept.-Oct. 1946.

Investigation of variations of the thiamin and riboflavin contents in pork in the raw state and in various stages of heat processing.

83G. Vitamin content of dehydrated meats.

WHITMORE, R. A., POLLARD, A. D. *et al. Food Res., 11,* 419-424, Sept.-Oct. 1946.

Data are presented to show that no significant loss of riboflavin and niacin occurred even at the highest temperatures and the longest periods of storage. The thiamin was stable at 40° F., but at 70° F. there was a definite loss after 30 days and a large loss after 42 weeks. At 100° F. and 120° F. the loss was apparent after one week and almost complete after 10 weeks' storage.

84G. Whatever it is, "X" is essential factor in diet.

U. S. Egg Poultry Mag., 52, 505, Dec. 1946.

Nutrient X, an unidentified food factor appearing to have the properties of a vitamin, seems to enhance the "palatability" of foods. Research reveals that X is present in egg yolk, several milk products, lettuce, beef and pork muscle, in bluegrass and alfalfa, and in alfalfa and timothy hays. The X in the diet is so essential that while rats on a diet relatively high in protein (65% protein) usually died if X was lacking, they lived and grew 85% of normal on the same diet when it was supplemented by Nutrient X.

85G. Synthesis of vitamin B_6.

SZABO, L. J. 2,410,531, Nov. 5, 1946.

A process of preparing vitamin B_6, the steps comprising treating 2-methyl-3-alkoxy 4, 5-bis (aminomethyl)-pyridine with hydrobromic acid as a dealkylating agent to form 2-methyl-3-hydroxy-4, 5-bis (aminomethyl)-pyridine, and reacting the resulting 2-methyl-3-hydroxy-4, 5-bis (aminomethyl)-pyridine with an agent selected from the group consisting of nitrous acid and products capable

of splitting off nitrous acid as a deaminating agent to form vitamin B_6.

86G. Concentration of fat-soluble vitamins.

SHANTZ, E. M. 2,410,590, Nov. 5, 1946.

The process of preparing a fat-soluble vitamin concentrate by reacting a glyceride fat which contains a fat-soluble vitamin with at least approximately stoichiometric amounts of a member of the group consisting of primary amines, secondary amines, and quaternary ammonium bases.

PACKAGING

87G. Packaging Institute standard test methods. Gas permeability of low-permeability films.

Mod. Pack., *20*, 151,152, Oct. 1946.

This article describes in detail the method developed by General Foods for determining the gas permeability of flexible films used in the packaging of foods.

88G. Odorless ink used for food packages.

General Printing Ink Co. *Food Field Rep.*, *14*, 14, Dec. 9, 1946.

A new quick-drying ink, completely lacking in odor, has been developed for use in the printing of wrappers and packages for food and candy. The new ink is now being used widely on paper milk containers, gum wrappers, and on containers for liquids and semi-liquids. The new product cannot now be used successfully on cellophane, 'pliofilm', or cellulose acetate.

89G. Films for produce . . . their physical characteristics and requirements.

PLATENIUS, H. *Mod. Pack.*, *20*, 139-143, Oct. 1946.

This article describes the physical requirements and characteristics of films for packaging fruits and vegetables. It covers the mechanisms of produce respiration in air-tight containers, and the requirements of O_2 and water-vapor permeabilities of films for produce.

News of the Institute

ACHIEVEMENT AWARD PRESENTATION

The first I. F. T. Achievement Award was presented at the luncheon session of the Seventh Annual Food Conference on June 2, 1947. The Award, in the form of a bronze plaque, is provided by *Food Industries* magazine. It is presented to the food processing company, selected by a jury appointed by the President of the Institute, with the approval of the Council, which is adjudged to have made the greatest achievement in food technology over the immediate past two-year period.

Remarks by Dr. L. V. Burton, Editor of Food Industries:

PRESIDENT HARVEY
MEMBERS OF THE INSTITUTE OF FOOD TECHNOLOGISTS
HONORED GUESTS
FRIENDS:

We are gathered here to institute a new custom. We hope that this ceremony will be the start of a long line of such occasions. The purpose of this meeting is to award a food company that has made an outstanding achievement in food technology.

The selection of the food processing company to receive the award is entirely in the hands of the Institute of Food Technologists. While the choice is now an open secret, I now call upon the chairman of the Jury that was appointed by President Harvey to inform us of the decision of the Jury—Professor B. E. Proctor.

Remarks by Prof. B. E. Proctor, Chairman of the Jury for the 1947 Food Industries Award

MR. CHAIRMAN, HONORED GUESTS, FELLOW JURYMEN, AND FOOD TECHNOLOGISTS:

In September 1946 the periodical *Food Industries* proposed to sponsor and donate an award to be given at intervals to the company in the food processing industry that had made the greatest achievement in food technology during that period. The purpose of this award is to stimulate progress in the industrial application of food technology by food manufacturing companies, and the award is given to a food company rather than to an individual, in order to encourage cooperative team work.

The responsibility for making this award in 1947 was placed in the hands of a jury of 15 men. The members of this jury are as follows:

Dr. Clyde H. Bailey—University of Minnesota, St. Paul, Minn.
Mr. Clarence Birdseye—Processes, Inc., Gloucester, Mass.
Dr. Morris J. Blish—International Minerals & Chemical Co., Rossford, Ohio.
Dr. E. J. Cameron—National Canners Association, Washington, D. C.
Mr. Louis E. Dietrich—American Home Foods, Inc., Pittsburgh, Pa.
Mr. Robert Dillman—Libby, McNeil & Libby, Chicago, Ill.
Mr. W. R. Junk—California & Hawaiian Sugar Refinery Co., San Francisco, Cal.
Mr. James McGowan—Campbell Soup Co., Camden, N. J.
Mr. Carl S. Miner—The Miner Laboratories, Chicago, Ill.
Mr. J. B. Pardieck—California Vegetable Concentrates, Inc., Huntington Park, Cal.
Dr. Bernard E. Proctor—Masachusetts Institute of Technology, Cambridge, Mass.
Mr. Allen H. Saul—Beechnut Packing Co., Canajoharie, N. Y.
Mr. Robert D. Scull—Burnham and Morrill, Portland, Me.
Dr. Ernest H. Wiegand—Oregon State College, Corvallis, Ore.
Dr. Laurence V. Burton—McGraw-Hill Publishing Co., New York (served as secretary)

It has been the duty of this jury to review the relative merits of a considerable number of outstanding applications for the Food Industries Award. The character and the scope of the important food processing achievements considered for this award have emphasized the wide variety in the progressive changes that have marked food technology in the war and the post-war years, changes that are already being reflected in food products of better quality, greater nutritive value, and lower cost, and in food manufacturing procedures that are more efficient technologically.

Many of the persons who have played an important role in these outstanding developments in food technology are members of our Institute of Food Technologists and some of them are in our audience today. The fruits of their labors will benefit the American public for decades to come. To these men we offer our congratulations for work well done.

To weigh the relative merits of these outstanding developments in food technology has not been a simple task, nor has the task been accomplished without serious and well-considered evaluation of the many factors involved. The only regret of the jury in arriving at a final decision has been that more than one award could not have been made, thus enabling the jury to allocate honors in all cases where honors are due.

For those organizations that have worked hard on important developments in food technology and perhaps merit recognition equal to that accorded today to the winner of the 1947 Food Industries Award, may I quote the following brief verse, which for many years graced the arch of the entrance of an athletic field in this vicinity.

"Not the quarry but the chase,
Not the laurel but the race,
Not the hazard but the play,
Make me, Lord, enjoy alway."

One might compare this competition with the famous Marathon race that takes place in the Boston area each nineteenth of April. This 26-mile grind of human endurance is symbolic of the ancient race run from Marathon to Athens some 25 centuries ago (490 B. C.) during a period of war-torn strife. Our food industries in this country have undergone an equally arduous period since the attack on Pearl Harbor, and the food industry receiving the 1947 Food Industries Award for progress in food technology under such circumstances, when even ordinary tasks have been so difficult of accomplishment, is equally deserving of the traditional laurel wreath.

It is our pleasure today to announce that the jury has concurred in giving the Food Industries Award for 1947 to the Atlantic Coast Fisheries Company for their development of continuous automatic fish filleting machines. Since 1921, when fish were first marketed in fillet form, the demand for a filleting machine to replace hand labor has been world wide. Untold amounts of time and money have been invested in efforts to develop such a machine, not only in the United States but in other countries such as Canada, Great Britain, Germany, Japan, and Russia.

In 1923 the Atlantic Coast Fisheries Company began work on developing an automatic filleting machine. After expending nearly 20 years of time and approximately a million dollars on this project, they developed and perfected filleting machines for cod, haddock, rosefish, and whiting. These machines are automatically adjustable for the full size range of the different varieties of these fish. Fillets can be cut, for example, from cod and haddock varying in length from 14 to 32 inches and in weight from 1 lb. to 10 lb. A crew of only nine men can operate the haddock filleting machine, and with 3½ lb. haddock filleted in the machine at a rate of 45

fish per minute the average man-hour output is 509 lb. of fillets as compared with an output of 210 lb. when the haddock fillets are prepared by skilled hand filleters.

In the case of redfish, the filleting machine is capable of operating at the rate of 75 fish per minute and no adjustment is necessary for differences in the size of the fish. A pilot redfish machine has been used as an experimental unit for work with other species of fish, and standard models are now built which take the fittings and attachments needed for handling other species of small fish. This equipment is, therefore, almost universal in its application. Indeed, the redfish, whiting, and cod-haddock machines can handle between them about 90 per cent of all fish now being filleted commercially.

One of the requirements for the award is that the process or invention should have been in commercial use for at least a year prior to the granting of the award. The Atlantic Coast Fisheries Company has been operating its filleting machines at Provincetown regularly since 1942 and its cod and haddock machines in Boston since 1943.

The advantages of these machines are many. One of the conspicuous advantages is that the equipment enables a *continuous* process, which is in reality the summation of a number of separate processes as filleting is practiced elsewhere. It is the dream of every progressive food manufacturer that the processes in his plant may be continuous. The automatic filleting machine of the Atlantic Coast Fisheries Company is a definite illustration of the practical attainment of such a goal.

Other advantages of the machines are that they enable the cutting of fillets that are more uniform in size and more attractive in appearance than hand-cut fillets, and that are produced under improved sanitary conditions.

One of the major advantages of these automatic filleting machines is that with their use the yield of merchantable fillets can be increased by 15 to 18 per cent over the yield by hand filleting. Skilled hand filleters can produce an average yield of 42 per cent of haddock fillets from the round fish, whereas the haddock filleting machine can produce a yield of 48 per cent.

This greater yield of fillets by the machine operation could considerably enlarge the nation's food supply of fish. For example, according to the fishery statistics of the United States for 1942, as reported by Anderson and Power of the United States Fish and Wildlife Service, some 93 million pounds of fillets of cod, haddock, and rosefish (fresh, frozen, and smoked) were manufactured in the United States and Alaska in 1940-1941. On the assumption that these fillets were prepared by hand, it is calculated that the automatic filleting machines of the Atlantic Coast Fisheries Company could have filleted some 13 million pounds in excess of the 93 million pounds. The consumption of fish of all kinds in the United States in 1940 averaged about 18 pounds per person. This means that the additional 13 million pounds of cod, haddock, and rosefish fillets that could have been manufactured by the automatic filleting machine would have supplied the yearly per capita requirements of fish for about 740 thousand people.

In view of the inadequate supplies of food in the war-torn countries of Europe at the present day, the fact that one country across the Atlantic is already planning to use equipment of the same design and manufacture as the automatic filleting machine of the Atlantic Coast Fisheries Company is of tremendous significance. Certainly this development has the potentialities of easing, to some degree, the problems we face in stretching the world's food supplies to the greatest possible extent. This development likewise has potentialities in reducing the labor involved in filleting, which has important economic advantages as well.

In arriving at this decision concerning the Food Industries Award for 1947, the

jury wishes to congratulate the Atlantic Coast Fisheries Company on the successful completion of this important technological development. The jury wishes likewise to commend the Atlantic Coast Fisheries Company for its vision, foresight, and persistent faith, which prompted it to support the technological and engineering phases of the project with adequate financial resources to attain the planned objective. This is a typical example of the successful combination of applied science and management which characterizes food technology on its highest level.

To all those who were concerned in the fruition of this magnificent development—to the food technologist who envisioned the original concept, to the management that sponsored and fostered the development, to the combination of skilled engineers and craftsmen who executed the designs, and to those who now proudly operate this efficient equipment—the jury extends its most hearty congratulations.

May your successful and outstanding efforts be an inspiration to others who likewise strive in their respective spheres to improve American food products and processes. And may it be the opportunity of some future jury to have the pleasant duty of honoring a company for successful achievement as we today honor the Atlantic Coast Fisheries Company and its personnel, the first recipients of the Food Industries Award.

Remarks by L. V. Burton:

Thank you, Professor Proctor, and thanks to the members of the Institute of Food Technologists who have served on the Jury for your difficult task of comparing and evaluating the relative technological merits of different processes, products and machines that were entered in the first competition.

Mr. Cooley, on behalf of the donor of the award that I have the honor to represent, I am happy to carry out the judgment of the Jury of the Award.

The purpose of conferring this award is to signalize an outstanding achievement in the field of processing. We hope that by this ceremony many other companies will be made to recognize the importance of food technology and utilize the services of the food technologist to the utmost. We hope that the entire field of food processing will be further advanced in technological efficiency by this newly recognized profession.

While we of the Institute are not yet in entire agreement as to the ultimate definition of food technology, I may speak for myself and say that I regard it as the integration of chemistry, bacteriology, biology and physics as applied to foods, and the application of this integrated combination as an engineering art to the industrial processing of food.

With no thought of the food technologist as such, your company has utilized the painstaking work of the food technologist. Your company has persevered until success has been attained.

Mr. Cooley, it gives me great pleasure to present to your company the bronze placque that symbolizes the first Award for Achievement in Food Technology.

I give you, Mr. Cooley, President of the Atlantic Coast Fisheries Company.

Remarks by Mr. E. H. Cooley, President, Atlantic Coast Fisheries Co., in acceptance of the Award:

PRESIDENT HARVEY, DR. BURTON, DR. PROCTOR, LADIES AND GENTLEMEN:

You know I am in rather an odd position today because I came with this company about two years ago, and I am the recipient of an honor belonging to other people for I had very little to do with the development of this machine. This honor

to me is only that which falls to the head of management. I want you to know that I am decidedly envious of the group of people I speak to today.

Those things which amount to something in industrial progress come not directly from the drafting board but from the struggles of many technologists who serve in the laboratory, at the test tables, and work night and day to determine what a little innocent appearing bug will bring into a laboratory and what it can grow up to be when applied to a commercial product.

Now, my company is one that profited by sticking to that kind of work. This machine originated in California; a father and son worked on it. It was good, but still there was so much work to be done that it would require many years to complete it. As a matter of fact, the technical men and the members of the Board of Directors together made it a success for the industry at a cost of between one million and two million dollars.

The order for machines was given to a plant believed to be solvent but which later proved otherwise. Our men had to take over the factory operation and our engineers had to go into the plant to work on the machines. Out of the original order of six only two were completed. One is in operation at the Fish Pier and the other is in Hull, England.

What is it that makes for success? I read the other day about the opening of the World's Fair in Chicago in 1933. There a light beam forty years old, originating in the star Arcturus, was utilized through man-made instruments to open that huge celebration—a clear indication of what part technological study and development, working through the cooperation of technologists and management, had in determining what particular feature or action really motivated the accomplishment.

The filleting machine itself is another indication of this cooperation between technologists and management bringing such efforts to fruition.

When I came to this company two years ago, I admit I looked at this machine as something that might be worthwhile, an animated Goldberg cartoon, but perhaps I can best express my conversion by quoting a well-known author; I believe this is from Gray's Elegy: "Fools who came to scoff remained to pray." I found that the actual shop records of the machine as kept from day to day proved conclusively its worth, if made available to the entire fishing industry.

One point that is of great importance to you people in the laboratory and in management is illustrated by the fact that the original patents on this machine—four in number—are soon to expire, but those four patents never created a machine that would work. There are today thirteen applications to be acted upon by the patent authorities of England and other countries, one just issued a few months ago in England. There are some fifteen applications now being processed in United States and two more are now ready for application to the United States Patent Office for further improvements. The point I am trying to make is that the need for technological study does not cease, but the worth of an idea is maintained by further study for improvements in a design. This is particularly interesting to management because the economic value of the original patent is carried forward year by year, thus protecting the dollar invested by the company.

Therefore, technological work and study are a necessary part of management and becoming more so day by day.

The men who should be here today include Mr. W. A. Ellison, head of the Machine Division of this company, and Mr. Charles Savrda, who is co-inventor and designer of the machine. These men are both in England at the present time. Incidentally, I had a letter from Mr. Ellison this morning. He writes about the people and about the demonstration and tells of those who have been privileged to

observe the operation of the equipment and those who are on committees connected with this matter. I remember one man particularly, who incidentally is a hero of the Great War. You will remember a group of twelve English heroes who were chosen to tour the United States to speak to the various factories here in an effort to spur up the output of necessary war materials. This man was one of those twelve.

There is one more interesting instance—I regret my inability to tell where this happened, but many of you will remember it. A group of men went off their battleships or cruisers using small boats into a port and almost totally destroyed or seriously damaged huge quantities of enemy war equipment and vessels. Only a few of these men returned to the ships and this man was the one officer who returned and brought with him some men who otherwise would have been lost.

In another instance, this same gentleman dived from the deck of his battleship and, by swimming under oil, helped others to safety. He received about all of the medals that a grateful government can bestow. Mr. Ellison writes me that this man came down to see the machine and admitted (I am attempting to quote): "I would have bet 10,000 to one against the machine, but I have been proved wrong."

If we should consider the matter of selling a doubting management on technical work, the best demonstration, of course, is the work done by the equipment produced or by the processes developed. This is the method we have used both in America and abroad to prove conclusively to those interested the worth of the cooperative result of which we speak.

I would like to ask just now, Dr. Burton, a question that may serve as an impetus. Where would industry be if we should stop such study? I would like to urge everyone in the room that he seek to enjoy a position similar to that in which I find myself today. This means that your company, your technical group, can all have proof of these benefits. Now, it may be that there are "Doubting Thomases," and that there are those who think that technological study is useless. I don't believe they really do think so, for I am sure that management itself does believe that technological study is a requirement. It is my definite belief that it is the secret of progress and success.

I could tell you many things about this machine, about new devices that are to be added so that it will be suitable for the use of many different kinds of fish. The staff is still working on its application to other species of fish and of new products. At the present time we have on the drafting board a machine that will fillet flat fish. There is a huge demand for machines for this purpose, both at home and abroad.

We also plan a new type of machine that will fillet twin fillets, known in the industry as butterfly fillets because the two fillets when left together take the shape of a large butterfly. Our technological staff is a definite part of this company and will be continued.

Doctor, let me again thank you for my company for the honor which you have bestowed and also inform you that we will be back again in your next contest with a new product which is now being put on the market.

Concluding Remarks by L. V. Burton:

On behalf of the publisher of *Food Industries*, Mr. M. A. Williamson, who conceived this award and has made it possible, I express my appreciation for the cooperation of the Institute of Food Technologists in carrying out this ceremony.

It is planned that the award may be conferred every alternate year, and that by recognizing outstanding achievements in food technology we can thereby focus greater attention on the important service of food technology.

News of Regional Sections

CHICAGO SECTION

On April 21, Dr. G. M. Dack, Professor of Bacteriology and Director of the Food Research Institute, University of Chicago, spoke to members of the Chicago Section on "Staphylococcus Food Poisoning: Past and Present." He likewise discussed the organization and objectives of the Food Research Institute.

On May 19, Dr. F. N. Peters, Vice President and Director of Research, Quaker Oats Company, Chicago, gave a talk on the subject "Are Federal Standards of Identity Assets or Liabilities for Food Technologists?"

The next meeting of the Chicago Section will be on October 20 at Henrici's Restaurant in the Merchandise Mart Building. The program is yet to be determined.

Mr. John T. Knowles, Chairman of the Section in 1945, acted for the Section in the presentation of the Nicholas Appert Medal to Dr. C. O. Ball at the 7th Annual Conference of the Institute of Food Technologists in Boston, June 2, 1947.

Two members of this Section were recently elected to vice presidencies of their respective companies. These are Mr. John T. Knowles of Libby, McNeill and Libby, and Dr. F. N. Peters of the Quaker Oats Company. Congratulations!

Mr. G. Y. Bonus, of Libby, McNeill and Libby, has been transferred from the General Superintendent's Office in Chicago to become manager of Libby's new cannery at Walworth, Wisconsin.

Mr. Morris H. Katz is now with the Martin Food Products, Inc., as food technologist and chemist.

NORTHERN CALIFORNIA SECTION

Congratulations to Professor Gordon C. Mackinney of the Division of Food Technology, University of California, a recent recipient of a Guggenheim Fellowship. Professor Mackinney will study carbohydrate chemistry with Professor Haworth in England.

We are very happy to report this award, because this is the first time a Guggenheim Fellowship recipient has been chosen from the field of food technology.

On April 24, members of the Northern California Section were addressed by two speakers, Dr. Michael Copley on "Rutin (Vitamin P)" and Dr. Floyd De Eds on "Pharmacology of Rutin."

According to the second issue of *The IFT Hornblower*, which appeared in April, the business manager is Jim Morgan and the production manager is Betty Swenson. The other officers were announced in the April number of Food Technology. The position of advertising manager is still open. Subscriptions to the *Hornblower* are open to every one at the rate of 50 cents per year.

It is suggested that all Northern California Section mail, including that of the *Hornblower*, be routed through the office of the secretary, i.e., 2545 Sixteenth Street, San Francisco, California. If necessary, the *Hornblower* editor (Walter S. Richert) can be reached directly: c/o Wine Publications, 717 Market St., San Francisco 3.

A joint meeting of the Northern and Southern California Sections is planned for October, during the Pacific Coast Chemical Exposition sponsored by the American Chemical Society.

The Membership Committee has made a survey of recent membership with a view toward securing more national members, and a policy has been adopted for encouraging student membership. Local dues for student members have been reduced from three dollars to one dollar per year. Additional regional associate

members cannot be accepted now, as the quota is filled. All regional associates who are eligible for national membership are urged to join the national organization.

Ed Winslow and Fred Yerman have consented to serve with Chairman McKirihan on the Employment Committee. This committee has formulated plans for serving the food industries of nothern California by making available to them full information on the qualifications of technical personnel available for employment. Questionnaires have been prepared for members and employers, which will establish a permanent file of openings and men available.

The Reception Committee has been authorized to design lapel badges for identification of members at meetings.

The Program Committee is to be congratulated upon having already set definite meeting dates and arranged all programs for the entire year.

Membership applications were approved for Julius H. Fessler, Charles V. Finell, Frank S. McKenzie, Paul E. Noland, Joel T. Osburn, Edward L. Prudhomme, Fred C. Roberts, Mason N. Skiff, Henry Seagrave-Smith, Robert R. Thompson, Ammed A. Rasheed, and Omar Foda.

At the end of 1946, Dr. T. L. Swenson left his position as Director of the Western Regional Laboratory to become Special Assistant to the Chief of the Bureau of Agricultural and Industrial Chemistry. After two months in this capacity, he returned to California and is now handling food research for the Stanford Research Institute.

Jim Hansen is now in Chicago, as assistant to John Knowles, in charge of research for Libby, McNeill and Libby.

Frank Hickey of Food Machinery was married to Ruth Warmke in Harlingen, Texas, recently. Congratulations.

NORTHEAST SECTION

Mr. Loren B. Sjostrom, of Arthur D. Little, Inc., has been elected a member of the Executive Committee for one year, to fill a vacancy caused by the removal of Dr. P. K. Bates to the Southern California Section.

The Northeast Section now has more than 165 members, of whom 155 are also members of the national society. The average attendance at the meetings during the past season was 150.

The Seventh Annual Conference of the Institute of Food Technologists was held in Boston, Massachuetts, June 1-5, 1947, with headquarters at the Hotel Statler. The total attendance was about 783, including, in addition to registered members, about 76 guests. Twenty-nine states and four Canadian provinces were represented. There were four visitors from Sweden, one from England, and one from India.

The distribution of members from the United States, Canada, and Newfoundland was as follows:

United States

Massachusetts	182
New York	136
Illinois	92
New Jersey	44
Pennsylvania	38
Ohio	26
Michigan	23
California	20
Maryland	14
Minnesota	13
Connecticut	12
Wisconsin	10
Florida	9
Maine	8
Missouri	8
District of Columbia	8
Iowa	6
Indiana	5
Delaware	4

Virginia	4	North Carolina	1
Rhode Island	4	Kentucky	1
Nebraska	2	*Canada*	
Tennessee	2	Ontario	13
Georgia	2	Quebec	5
Kansas	2	Nova Scotia	4
Louisiana	2	British Columbia	1
Colorado	1	*Newfoundland*	1
West Virginia	1		

During the scientific sessions of the Conference many interesting and stimulating papers were presented, dealing with food technology in relation to management, research and development management, sanitation in food handling and storage, processing sanitation, refrigeration and freezing, and fisheries technology. The scientific meetings as a whole were much better attended than has ever been the case previously.

At the first session on Sunday evening, June 1, more than 300 people were present to hear the symposium on "Applications of Colloidal Chemistry in Food Processing." This symposium, under the chairmanship of Mr. Robert S. Scull, was addressed by Dr. Ernst Hauser, Professor of Chemical Engineering of the Massachusetts Institute of Technology. The address and the discussion that followed proved to be extremely interesting.

Highlights of the Conference were the presentation of the first Food Industries Achievement Award to the Atlantic Coast Fisheries Company for its development of a continuous, automatic fish filleting machine and the presentation of the Nicholas Appert Medal to Dr. Charles Olin Ball of the Owens-Illinois Glass Company, Toledo, Ohio.

Dr. Ball gave an excellent presentation of the subject "Mathematics and Experiment in Food Technology," and Dr. George R. Harrison, Dean of Science at the Massachusetts Institute of Technology, gave an extremely stimulating address on "New Advances in Science."

Members and their guests attended a "Pops" Concert at Boston Symphony Hall on the evening of June 3. A clambake and lobster shore dinner was served to some 600 members and guests at Gloucester, Massachusetts, on the evening of June 4. The anticipated boat trip to Gloucester unfortunately had to be cancelled because of rough seas, and the group was transported by a special train on the Boston & Maine Railroad. The train ride proved to be a most happy substitute, providing ample opportunity to make new friends and to renew old friendships. Many of the members of I. F. T. learned for the first time how to eat steamed clams and boiled lobster.

Considerable effort was devoted to make the attendance at the Conference a happy one for the ladies. An afternoon tour of some dozen gardens on Beacon Hill was enjoyed by a group of about 30 ladies, thanks to the courtesy of members of the Beacon Hill Garden Club, who graciously opened their gardens and, in some instances, their homes for this purpose. There were also special bus tours for the ladies, including an all-day tour covering downtown Boston, Cambridge, Lexington, and Concord, with stops at different historic spots and luncheon at Longfellow's Wayside Inn in Sudbury, Mass., where approximately 70 ladies were the guests of the Institute.

On the last day of the Conference, opportunity was had to visit various industrial plants in and around Boston, including the Atlantic Coast Fisheries plant where their automatic fish filleting machines were on display. The plants visited were as follows:

Walter Baker Co., Milton, Mass. (chocolate and cocoa).
Atlantic Coast Fisheries and General Seafoods Corp., Boston Fish Pier (fish processing).
Department of Food Technology, Massachusetts Institute of Technology, Cambridge, Mass. (teaching and research laboratories).
Dewey and Almy Chemical Co., Cambridge, Mass. (food packaging materials).
First National Stores, Somerville, Mass. (grocery manufacture and distribution).
The Foxboro Company, Foxboro, Mass. (control instruments for food processing).
Gorton Pew Fisheries Co. Ltd., Gloucester, Mass. (fish processing).
H. P. Hood and Sons, Charlestown, Mass. (milk and ice cream).
Arthur D. Little, Inc., Cambridge, Mass. (consulting chemists).
National Biscuit Company, Cambridge, Mass. (crackers).
Raytheon Manufacturing Company, Waltham, Mass. (electronic equipment, Radarange).
Revere Sugar Refinery, Charlestown, Mass. (sugar processing).
W. F. Schrafft and Sons Corp., Boston. (chocolate and candy).
William Underwood Co., Watertown, Mass. (canned meats).
Ward Baking Co., Cambridge, Mass. (bakeries).

The scientific program was commended highly by many members, and the various forms of entertainment were apparently enjoyed by every one. So far as is known, everybody went home happy.

Although final accounts of expenditures and income for the Conference have not yet been completed, it is anticipated that a substantial financial contribution will be made to the national Institute as a result of the Boston meeting.

SOUTHERN CALIFORNIA SECTION

On March 26, Mr. C. R. Havighorst of *Food Industries* spoke on "Frozen Food Industry in 1947—Recent Developments."

On April 30 a general outline of the entire Quartermaster Research Program on Foods was presented. The address of the evening was "The Effectiveness of Preserved Foods in Normal Nutrition" by Dr. Harry Duell, head of the Department of Biochemistry, School of Medicine, University of Southern California. This covered the work Dr. Duell has been doing in conjunction with the Quartermaster Food Research Program.

Hosts for the meeting on May 16 were Fruit Industries, Ltd., at their winery in Guasti. This meeting was an outstanding success both educationally and gastronomically. Approximately 80 members were in attendance. The meeting started with a tour of the bonded warehouse, followed by a tour of the Champagne and Wine Processing Plant of Fruit Industries, Ltd. During the dinner, a talk on "Wine, Wine-Making, and Fermentation" was presented by Mr. Frank Diane.

On June 20, the Los Angeles campus of the University of California played host to the Los Angeles food industries, under the auspices of the Southern California Section. An all-day conference was held on "Industrial Waste Disposal" and on "Economic and Research Problems of California Agriculture." The welcoming address to the food industries was given by the chairman of the Section, Mr. W. C. Platt, and papers were presented as follows:

"Industry's Obligation—A Farmer Estimates the Situation." Mr. Ross A. Shafer.

"Clean Waters." Picture in color and sound on industrial waste, supplied by the Southern California Edison Co.

"Limitations on Industrial Waste Disposal in Los Angeles Metropolitan Area." Mr. Arthur Pickett, Industrial Waste Engineer, Los Angeles County.

"Rules and Regulations Governing Waste Disposal in Los Angeles City." Mr. Warren A. Schneider, Waste Disposal Engineer, Los Angeles City.

"Industrial Waste Disposal as Effecting Industrial Expansion—Especially in Orange County." Mr. Harvey F. Ludwig, Ludwig and Bacon, Consulting Engineers.

"Utilization of Waste and Solving Disposal Problems." Dr. Richard Pomeroy, Consulting Chemical Engineer.

Summary of papers presented and round table discussion of questions, conducted by Mr. A. M. Rawn, Chief Engineer and General Manager, Los Angeles County Sanitation Districts.

The dinner address was given by Mr. F. R. Wilcox, Assistant General Manager and Treasurer, California Fruit Growers Exchange, who spoke on the "California Agricultural Research Program and its Effect on the Food Industry."

It is planned to have mimeographed copies made of the entire text of the June 20 papers, and these will be distributed as "Proceedings."

ST. LOUIS SECTION

At the May meeting of the St. Louis Section the guest speaker was Dr. C. Estes of the Anheuser-Busch Laboratories. Dr. Estes discussed the "Production and Uses of Malt."

On June 21 the Section enjoyed an outing at the Purina Research Farm at Gray Summit, Missouri.

FLORIDA SECTION

At a meeting of the Florida Section held on May 27, 1947, in Winter Haven, Florida, the following new officers were elected:

Chairman—M. K. Veldhuis, U. S. Citrus Products Station, Winter Haven, Florida.
Vice Chairman—T. J. Kew, Dr. P. Phillips Canning Co., Orlando, Florida.
Secretary-Treasurer—R. D. McKinnis, American Machinery Corporation, Orlando, Florida.
Section Councillor—R. D. Gerwe, Food Machinery Company, Lakeland, Florida.
Executive Committee—G. N. Pulley, Kuder Citrus Pulp Company, Lake Alfred Florida; R. R. McNary, U. S. Citrus Products Station, Winter Haven, Florida.

The following members of the Executive Committee continue in office:

T. J. Kew, Dr. P. Phillips Canning Company, Orlando, Florida.
D. W. Riester, American Can Company, Tampa, Florida.

Dr. R. D. Gerwe attended the 7th Annual Conference of the Institute of Food Technologists held in Boston June 1-5, 1947, and represented the Florida Section as Councillor.

WESTERN NEW YORK SECTION

At the spring meeting of the Western New York Section on April 25, the following program was provided:

(1) "What the Merchandiser Expects in the Way of Packaging." Miss Mary Kelly.

(2) "Refrigerated Transportation." G. A. Fitzgerald.

(3) "Improved Quality in Vacuum Packed Vegetables—the Agitating Vacuum Process." John E. Fix.

(4) "Packaging Frozen Foods and Dairy Products." G. H. Sullivan.

(5) "Packaging Fresh Produce." Don Griswold.

(6) "Bacteriological Aspects of Packaging." J. R. Sanborn.

The dinner address at this meeting was delivered by Dr. J. B. Sumner of Cornell University, a recent recipient of the Nobel Prize in Chemistry for his work on enzymes.

GREAT LAKES SECTION

The spring meeting of the Great Lakes Section was held on April 18 at Toledo, Ohio. In the morning there was a trip through the Libby Glass Company. In the afternoon three papers were presented, as follows:

(1) "Canning in Canada." Mr. L. J. Frost, Manager, Research Department, Continental Can Company of Canada, Ltd.

(2) "Results of Research in Food Technology in Horticulture at Ohio State University for 1946." Dr. H. D. Brown, Professor of Vegetable Gardening at Ohio State University.

(3) "Some Frozen Food Investigations at Michigan State College." Dr. Pauline Paul, Assistant Professor of Foods and Nutrition, Michigan State College.

The evening speaker at the dinner was Judge Harvey G. Straub, Judge of Common Pleas Court, Lucas County, Ohio, who talked on "Humorous Courtroom Incidents."

PHILADELPHIA SECTION

On February 13, an address on "Today's Picture of a Food Technologist" was presented before the Philadelphia Section by Dr. W. A. Maclinn, Chairman of the Department of Food Technology of Rutgers University. Dr. Maclinn discussed the need for a broad practical and academic training of food technologists, to fit them for their responsibilities in industry.

On April 10, Dr. C. G. King, Scientific Director of the Nutrition Foundation, New York City, spoke on "Nutrition Research in the Food Industry."

Copies of the latest mailing list of the Philadelphia Section have been mailed to members for verification and correction of any errors. The list contains 114 names. This annual check-up of membership list and addresses is well worth the effort involved and is a procedure that could well be copied by the other Regional Sections.

On the afternoon of May 22, members of the Philadelphia Section, their wives, and friends were escorted on a tour of the Deerfield Packing Corporation at Seabrook Farms, Bridgeton, N. J., one of the largest food freezing plants in the country. In the evening a symposium was held on food processing. The speakers at this symposium and the subjects of their talks were as follows:

Mr. C. Courtney Seabrook, Sales Manager, Deerfield Packing Corporation. "The Frozen Food Industry."

Mr. J. J. Sampey, Abbotts Dairies, Inc. "The Dairy Industry."

Dr. E. F. Kohman, Campbell Soup Company. "The Canning Industry."

At the close of these talks, the meeting was thrown open for discussion and questions from the floor.

The officers of the Convention Committee to make plans for the annual meeting of the Institute of Food Technologists to be held in Philadelphia in 1948 are as follows:

Honorary Chairman—Mr. James McGowan, Campbell Soup Co.
General Chairman—Mr. E. Everett Meschter, American Preserve Co.
Secretary—Mr. Earl Graham, Crown Can Co.
Vice Chairman—Dr. E. F. Kohman, Campbell Soup Co.
Committee Chairmen:

Finance—Mr. L. W. Mahle, Frank H. Fleer Corp.
Hotel and Housing—Mr. Carl Stone, Wm. S. Scull Co.
Registration—Mr. J. J. Sampey, Abbotts Dairies Inc.
Luncheon and Banquet—Mr. R. A. Pouchain, Tasty Baking Co.
Smoker and Entertainment—Dr. G. T. Reich.

Guests—Mr. G. L. Baker, University Delaware.
Exhibits—Mr. Earl Graham, Crown Can Co.
Meetings—Dr. Walter Obold, Drexel Institute.
Publicity and Printing—Dr. L. S. Hyde, American Stores Co.

The Philadelphia Section is planning to have a seminar in food technology next year. Mr. O. C. Wagner, of the Campbell Soup Company, has been named Chairman of the Seminar Committee and Dr. W. A. Maclinn, head of the Department of Food Technology at Rutgers, has offered to conduct a seminar once or twice each month. Each session will deal with a specific subject, such as sterilization, plant sanitation, preserving nutritive values, etc. The meetings will be open to any one interested.

PUGET SOUND SECTION

The Puget Sound Section held its second meeting of the year on April 29, at which time Dr. Carl Lindegren (Walker-Ames Professor of Botany at Washington University, St. Louis, Missouri) spoke on "Domesticated and Industrial Yeasts."

LIST OF REGIONAL SECTIONS, WITH NAMES AND ADDRESSES OF CHAIRMEN AND SECRETARIES

CHICAGO:
Chairman: Mr. C. C. Zeigler, Swift & Company, Union Stock Yards, Chicago, Ill.
Secretary: Dr. John M. Jackson, Research Division, American Can Co., Maywood, Ill.

NORTHERN CALIFORNIA:
Chairman: Dr. Emil M. Mrak, Food Technology Department, University of California, Berkeley, Calif.
Secretary: Mr. Ernest E. Jacobs, Lyons-Magnus Co., Inc., 2545 16th St., San Francisco, Calif.

NORTHEAST:
Chairman: Prof. William L. Campbell, Department of Food Technology, Massachusetts Institute of Technology, Cambridge 39, Mass.
Secretary: Mr. John J. Austin, Dewey & Almy Chemical Co., 62 Whittemore Ave., Cambridge, Mass.

SOUTHERN CALIFORNIA:
Chairman: Mr. Marsden Burns, California Vegetable Concentrate.
Secretary: Mr. Louis B. Rockland, Department of Chemistry, University of California, Los Angeles 24, Calif.

ST. LOUIS:
Chairman: Mr. E. H. Parks, Crown Can Company, St. Louis, Mo.
Secretary: Miss Mary B. Scott, Ralston Purina Co., St. Louis, Mo.

NEW YORK:
Chairman: Mr. A. G. Olsen, General Foods Laboratories, Hoboken, N. J.
Secretary: Mr. R. H. Rogers, Jr.

FLORIDA:
Chairman: Dr. M. K. Veldhuis, U. S. Citrus Products Station, Winter Haven, Florida.
Secretary: Dr. R. D. McKinnis, American Machinery Corporation, Orlando, Florida.

WESTERN NEW YORK:
Chairman: Mr. W. J. Hahn, Beech-Nut Packing Co., Rochester, N. Y.
Secretary: Dr. Frank A. Lee, Division of Chemistry, New York State Agricultural Experiment Station, Geneva, N. Y.

GREAT LAKES:
Chairman: Dr. L. S. Roehm, Dow Chemical Co., Midland, Mich.
Secretary: Dr. Roy E. Marshall, Michigan State College, E. Lansing, Mich.

PHILADELPHIA:
Chairman: Dr. George L. Baker, Delaware Agricultural Experiment Station, Newark, Delaware.
Secretary: Miss K. Langwill, Drexel Institute of Technology.

PUGET SOUND:
Chairman: L. P. Callahan.
Secretary: N. J. Willett.

Selected Abstracts

ANALYTICAL METHODS

90G. The profession of analytical chemist.

MURPHY, W. J. *Anal. Chem., 19,* 145, Mar. 1947.

"The analytical chemist all too frequently still is thought of as a strictly routine worker, one who is several steps below the research chemist and members of the chemical profession generally. He frequently suffers in prestige and monetary rewards because of the continued belief in this outmoded tradition."

The editors describe the development of the profession of Analytical Chemist and suggest a program for improving the relative status in the chemical field. Suggested in this program: distinction between professional chemist and laboratory technician, improvement in college curricula, awards for outstanding work, education of industry and management on the true importance of analytical chemistry.

91G. Further studies on Ofner's method for the determination of invert sugar.

MCDONALD, E. J., AND TURCOTTE, A. L. *J. Assoc. Off. Agr. Chem. 30,* 124-130, Feb. 1947.

The Jackson and McDonald modification of Ofner's method for determination of small amounts of invert sugar in the presence of sucrose has been further checked, and an improved method of calculating the results developed.

92G. Determination of the titratable acidity of milk.

ZILLIOX, E. H., MITCHELL, D. J., AND FRARY, G. G. *J. Assoc. Off. Agr. Chem., 30,* 130-134, Feb. 15, 1947.

A change in the method of determining the titratable acidity of milk is recommended, i.e., 17.6 ml. of milk is diluted with twice its volume of carbon-dioxide free water, titrating to the first permanent pink with 0.1 N NaOH, using 1 ml. of 2% phenolphthalein as indicator.

93G. Colorimetric determination of DDT in milk and fatty materials.

SCHECHTER, M. S., POGORELSKIN, M. A., AND HALLER, H. L. *Anal. Chem., 19,* 51-53, Jan. 1947.

A procedure is described for the colorimetric determination of DDT in footstuffs containing a considerable amount of fatty matter. DDT can be determined in quantities as low as 1 p.p.m.

94G. The recovery of DDT from canned foods and its stability during processing.

TRESSLER, C. J. *J. Assoc. Off. Agr. Chem., 30,* 140-144, Feb. 15, 1947.

Clifford's adaptation of the Schechter colorimetric method for DDT has been applied to the determination of DDT in canned foods. The DDT is extracted with benzene in the presence of anhydrous sodium sulfate. DDT was found to be stable to heat in water and acid buffer solutions, but was decomposed to a greater degree when processed with various foods.

95G. Determination of copper in food.

HIGH, J. H. *Analyst 72,* 60-62, Jan. 1947.

Failure to obtain complete recovery of copper from food ashes is attributed in part to incomplete solution of reduced copper in HCl. Aqua regia is claimed to be superior, giving results comparable to the wet ashing technique. Colorimetric measurement of the resulting solution by diethyldithiocarbamate is simplified. A detailed procedure is given.

96G. The determination and isolation of the organic acids in fruit.

ISHERWOOD, F. A. *Biochem. J., 40,* 688-695, 1946.

A simple method has been devised to extract both volatile and non-volatile acids without subjecting any of the solution to a temperature above 35°. Extractions of the acidified fruit are made with 50% (V/V) n-butanol - chloroform. Tert. - amyl alcohol-chloroform solutions of the isolated acids are then used in a modified Martin-Synge procedure. Important improvements are the use of an external indicator, the replacement of water by 0.5N H_2SO_4, and the use of a non-absorbent silica gel.

97G. The principles of chromatography.

MARTIN, A. J. P. *Endeavour 6,* 21-28, Jan. 1947.

Principal features of technique and theoretical considerations are illustrated and discussed.

98G. Studies in vitamin A. 1. A chromatographic method for separating free and esterified vitamin A.

GLOVER, J., GOODWIN, T. W., AND MORTON, R. A. *Biochem. J., 41,* 94-96, (1947).

A chromatographic method of separating vitamin A alcohol and esters, satisfactory in the presence of sterols, has been devised using defatted bone meal as adsorbent.

99G. Study of method of vitamin C determination.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. *Bibl. Sci. Ind. Reports, 4,* 952, (PB 58146), Mar. 14, 1947.

A simplified method for the determination of vitamin C in fresh fruits and vegetables in the field is described. The samples are extracted with a single acid instead of a combination of two acids and are filtered instead of being centrifuged. Otherwise the technique is the same as the usual laboratory technique. For cantaloupes, apricots, nectarines, green gage plums, Thompson seedless grapes, cauliflower, and tomatoes, the extractant recommended is metaphosphoric acid in a concentration of 4%. For lima beans and lettuce a concentration of 6% of this acid is preferable. Strawberries, Damson plums, and Malaga and Concord grapes cannot be analyzed by the dye titration method, but an indophenol-xylene extraction method is recommended.

100G. Study of method of vitamin C determination.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. *Bibl. Sci. Ind. Reports, 4,* 952, (PB 58149), Mar. 14, 1947.

This study was undertaken to determine what constitutes the most suitable concentration of trichloroacetic acid to be used with 2% of metaphosphoric acid for extraction of vitamin C in different vegetables and fruits. A summary of the data obtained with different vegetables and fruits is presented in tabular form. With fruits, a combination of 3% of trichloroacetic acid with 2% of metaphosphoric acid was adequate in all cases. There was a tendency toward lower values for reduced ascorbic acid in certain of the vegetables that were extracted with 8% of trichloroacetic acid plus 2% of metaphosphoric acid. These vegetables included rutabagas of both the Macomber and purple top yellow varieties, cabbage, onions, and quick-frozen materials, such as Brussels sprouts, green peas, and lima beans. On the other hand, the values for reduced ascorbic acid in turnips, potatoes, green peppers, pimientos (canned), tomatoes, and citrus fruit juices were not significantly different with any of the four types of extractants studied. Effect of concentration of trichloroacetic acid upon deproteinization of extracts is discussed.

101G. Determination of ascorbic acid in sulfited and fresh products.

BALAKHOSKII, S. D. *Biokhimiia, 8* (5/6), 275-282, (1943); *Biol. Abst., 21,* 41, No. 360, Jan. 1947.

A sample of 0.5-2 gm. is suspended in 30 ml. water, and acidified with a drop of glacial HOAc/ml., heated just to boiling, and cooled. After filtration, ascorbic acid is detd. in a 10 ml. aliquot by titration with dichlorphenolindophenol. To another 10 ml. are added a few drops of HOAc and 3 ml. of a soln. of Na_2S-H_2S (prepd. by satn. of 0.1 N NaOH with H_2S). After 1 hr. the excess S— is pptd. with 10% Pb $(OAc)_2$, the soln. is filtered, again acidified and heated to boiling, and the ascorbic acid is titrated as before. In this procedure dehydroascorbic acid is reduced and detd.; SO_2 as well as other interfering substances are eliminated.

102G. Oxalic acid extractant in vitamin C assay.

WOKES, F. *Analyst 72,* 63, Jan. 1947.

Solutions of oxalic acid have advantages over metaphosphoric or trichloroacetic acid as extractants for vitamin C in being cheaper and more stable, and avoiding precipitation of protein, while effectively inhibiting the action of ascorbic acid oxidase. It is particularly suitable for tomatoes and similar large fruit, but less satisfactory for walnuts.

BACTERIOLOGY

103G. The origin and control of thermoduric organisms. Some fundamental phases.

LEVOWITZ, D. *N. Y. State Assoc. Milk Sanit., Ann. Rpt., 19,* 219 (1945); *J. Dairy Sci., 30,* A13, Feb. 1947.

Thermoduric bacteria are present in milk freshly drawn from normal, healthy cattle. Research has not established whether poor health of cows raises their numbers. The cow does not affect the thermoduric content of milk enough to affect municipal milk standards. Bedding, manure, and feed dusts are sources of thermoduric bacteria. The sediment test would begin to mean something if straining of milk on the farm were eliminated, and contamination of milking machines with thermoduric bacteria may become important when machines are not handled properly. Although thermoduric bacteria are not pathogens, they are associated with unclean equipment surfaces and should be held at minimum numbers. High-temperature, short-time pasteurization cannot yield thermoduric counts as low as the holder method.

104G. Thermal death range of bacteria in milk. A new electric sampling device.

GILCREAS, F. W., AND O'BRIEN, J. E. *N. Y. State Assoc. Milk Sanit., Ann. Rpt., 19,* 237 (1945); *J. Dairy Sci., 30,* A14, Feb. 1947.

Study of the destruction of pathogenic bacteria by temperatures higher than now employed in the dairy industry is needed. Recently the Trumbull Electric Co. of Plain-

ville, Conn., constructed a mechanism which makes possible laboratory pasteurization with accurate one-second holding intervals. The equipment is electrically activated and adds culture and withdraws samples by syringes. Tests were made on one ordinary Escherichia coli culture and two heat-resistant strains from the U. S. Public Health Service. It was concluded that the thermal death range based on results of repeated tests with many cultures can be determined.

105G. The influence of salt on acid production by lactic acid bacteria.

PLATON, B. *Svenska Myeritidn.*, 1942(43), 427-433, (1942); *Biol. Abst., 20,* 2187, No. 20653, Dec. 1946.

Samples of pasteurized skim milk, inoculated with 2% of starter, were incubated at 20° C. and additions of 0 to 5% of salt were made 0, 2, 4, 6 and 8 hours after incubation began. The effect was plotted over periods of 34 hours. The time at which the salt was added bore no relationship to the ensuing shape of the curve, although this naturally differed in every case. The experiment shows that acid production, as affected by salt, can vary with the time of adding the salt, the temperature of the milk and the type of milk used.

FOOD PRODUCTS

BAKING AND BAKERY PRODUCTS

106G. Glycerine in baked goods.

LEFFINGWELL, G., AND LESSER, M. A. *Food Mat. Equip., 7,* 7, Mar. 1947.

Glycerine serves as a moisture retaining agent in cakes and sweet goods, and serves as a freshness retainer for bread. Glycerine also preserves the physical and chemical properties of frozen eggs; these eggs yield better baked goods.

CANNED FOOD

107G. The nutritive value of canned foods. XVIII. Further studies on carotene, ascorbic acid, and thiamine.

HINMAN, W., HIGGINS, M. M., AND HALLIDAY, E. G. *J. Am. Diet. Assoc., 23,* 226-231, Mar. 1947.

Carotene, ascorbic acid, and thiamine determinations were carried out on thirty-two canned fruits and vegetables from 1943 packs, many of them in both consumer-and institutional-size cans. Twenty-one of the foods assayed for these vitamins from 1942 packs were again studied, and eleven new foods were added: blackberries, blueberries, red sour pitted cherries, white and yellow cream-style corns, kraut, red peppers, mushrooms, pimentos, sweet potatoes, and turnip greens. Comparisons made with previous assays whenever possible indicate that, on the whole, the ranges and averages of vitamin values for the two years were in good agreement. Only one average value, that for ascorbic acid on orange juice, was significantly lower than in the previous year. There were notably higher averages on corn, beets, and prunes. For thiamine, somewhat higher results on grapefruit juice and segments and on tomatoes and tomato juice were also noted.

108G. Influence of processing technique on vitamin retention in canned corn.

FEASTER, J. F., TOMPKINS, M. D., AND IVES, M. *Canner, 104,* 16-18, Mar. 8, 1947.

Thiamine and niacin retention studies in cream style corn have been undertaken at the American Can Co., to determine their effect, using the high-short type of processing technique, as compared with the effect of conventional processing. Thiamine was chosen for study since it is known to be unstable to heat imposed during thermal processing. Niacin was included in the experiment because prior studies have shown this vitamin to be relatively stable to heat. The results obtained are presented graphically which shows the survival of thiamine and niacin in the final product after high-short and conventional processing.

CEREALS AND GRAINS

109G. Further studies on nutritional improvement of cereal flours and cereal grains with yeast.

SURE, B. *J. Am. Diet. Assoc., 23,* 113-119, Feb. 1947.

Further evidence has been presented on the marked nutritional benefits obtained by the additions of small amounts of a cultured food yeast (Strain G) to the proteins of enriched refined wheat flour, to 80% extraction flour, and to milled white corn meal. Data are also presented on the influence of additions of small amounts of this yeast to the proteins in polished rice and rolled oats. The proteins in polished rice were found to be three times as efficient biologically as those in enriched white flour, when fed on the same level of protein intake. For the same amount of food as well as for the same protein level of intake, the proteins of polished rice are still much superior to those of enriched wheat flour.

110G. Commercial production and use of mold bran.

UNDERKOFLER, L. A. *et al. Cer. Chem., 24,* 1-22, Jan. 1947.

The fungal amylase preparation, mold bran, offers a cheap source of enzyme for the

saccharification of grain and potato mashes, for alcoholic fermentation and for the saccharification of grain for the production of enzyme-converted syrups. Methods of manufacture are described.

111G. Bulk storage of flour.

HETTELSATER, A. R. *Northwest. Miller, 229,* 1a., Jan. 14, 1947.

Review of principal advantages in storing flour in bulk and a discussion of how much storage space to build and how to build it.

112G. Steel bins for flour storage.

GRANZOW, E. F. *Northw. Miller, 229,* 11a-12a, Mar. 11, 1947.

The flour packing and loading departments in flour mills offer opportunities for reducing production costs by the use of bulk flour storage bins. There are several advantages in favor of bulk flour storage as a means of effecting savings in production costs. The principal advantage is that the installation of storage bins permits a mill to pack its 24-hour output during the day shift. This insures that the best supervision will be given to packing and loading the flour, and that its quality will meet with the standards guaranteed by the mill.

113G. Wheat-flour consumption in the Philippines is mounting.

MANESS, H. *For. Com. Wkly., 27,* 6-7, Apr. 5, 1947.

The United States will, no doubt, continue to be the largest supplier of flour to the Philippines. It is believed that the imports during the next year or so will be about 80% American soft- and hard-wheat flour and 20% Canadian hard-wheat flour.

114G. Wheat starch process.

GALLAGHAN, R. W., AND SCHILLING, R. H. 2,418,621, Apr. 8, 1947.

Process of preparing wheat starch which comprises forming a dough containing wheat starch and gluten, working the dough with water to convert the dough into a starch slurry and a gluten mass, separating the starch slurry from the gluten mass.

115G. Wheat starch process.

SCHILLING, R. H. 2,418,669. Apr. 8, 1947.

Process of separating starch from gluten in a wheat product which comprises forming a dough containing starch, gluten and water, working the dough with water to form a mixture of gluten and a starch slurry, separating the starch slurry from the gluten, adding to the starch slurry a water soluble metal.

116G. Effect of parboiling on thiamine in rice.

KIK, M. C. *Cer. Chem., 23,* 529-539, Nov. 1946.

Deals with the effect of simple, controlled, standardized methods of parboiling of rough rice on thiamine content of the milled product (milled to approximately 10% bran removal). These methods include boiling; boiling and steaming; steaming; soaking and steaming; soaking, boiling and steaming. The data showed that boiling alone is unsatisfactory.

COFFEE, TEA, AND COCOA PRODUCTS

117G. Nicotinic acid content of coffee.

HUGHES, E. B., AND SMITH, R. F. *J. S. C. I., 65,* 284-6 (1946); *Brit. Abst., BIII, 14,* Jan. 1947.

From 16 to 44 μgr. of nicotinic acid (I) per gr. were found in samples of raw coffee beans. (I) is produced during the roasting of coffee by the decomp. of trigonelline present in the raw beans. The production of (I) is dependent on the extent of roasting, a dark-roast coffee containing more than a light-roast coffee. Normal samples of roasted coffee contained 95-263 μgr. of (I) per gr. The (I) content of coffee is not dependent on the variety of bean. (I) is almost completely extracted in the prep. of the beverage for drinking, the amount in a cup of white coffee (200 ml., half 10% coffee decoction and half milk) being 1-2 mg. The C_6H_5N in coffee also originates from the decomp. of trigonelline.

118G. Highlights on cocoa.

COOK, I. L. *Conf. J., 73,* 18, Mar. 1947.

Cocoa production has declined seriously. The chocolate industry and cocoa trade in this country, cooperating with the U. S. Department of Agriculture have formed a research committee to survey conditions in existing growing areas, and to explore new areas for cocoa development.

DEHYDRATED FOOD

119G. Investigation of Salmonella content of powdered whole egg with not more than 2% moisture content. III. Effect of preheater on survival of species of Salmonella during commercial spray drying.

SCHNEIDER, M. D. *Food Res., 11,* 521-524, Nov.-Dec. 1946.

Commercial dryers of the Rogers and Douthitt types, using preheaters, showed a very significant reduction of the Salmonella content of whole-egg powder with not more than 2% moisture content.

120G. Spray dried whole eggs improved with carbohydrates.

DAWSON, E. H., WOOD, E. A., AND MCNALLY, E. H. *Food Ind., 19,* 107-110, Apr. 1947.

Carbohydrates, added to whole egg before spray drying, exert a protective effect during drying and retard deterioration in storage. Eggs thus treated produced satisfactory baked goods after months at 100 degrees F.

121G. Development of dehydrated citrus powders.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. *Bibl. Sci. Ind. Reports, 4,* 951, (PB 58140), Mar. 14, 1947.

This report summarizes in detail the research carried on during the fiscal period of 1944-1945, and presents all the pertinent information available at this time in these laboratories concerning the theory and practice of dehydration from the frozen state. The purpose of the research during this period was to investigate the physical characteristics of products, and the equipment to be used in dehydration of material from the frozen state, with a view to the development of a commercial type of operation and with special emphasis on citrus fruit juices, especially orange juice. Tests were also made on other materials such as eggs, fruits, various fruit juices, gelatin, milk, syrups, vegetables and yeast. Plans are discussed for the design and construction of a pilot-plant unit embodying the principle of infrared vacuum dehydration. Photographs, drawings, graphs and a glossary are included.

122G. Development of dehydrated citrus powders.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. *Bibl. Sci. Ind. Reports, 4,* 951, (PB 58150), Mar. 14, 1947.

The major portion of the four-month period covered by this report was consumed in the assembly of the equipment and the construction of the vacuum belt drier employing infrared lamps described here. In the remaining portion of the period there was time only for a few preliminary runs in this drier. As a result of these runs, it was determined that the machine was capable of producing an orange juice powder having a moisture content as low as 1.2% and with little or no loss in color, vitamin C content, or flavor. Prior to dehydration in the vacuum belt drier, the orange juice was concentrated to a total solids content of approximately 59%. Photographs and drawings of vacuum belt drier, and details of the hopper mechanism for collection of the dry product, the assembly of the vacuum can packer, and the valve mechanism used in the packer to seal off the compartment from the tank when desired, are included.

123G. Retention of vitamins and palatability in large-scale food service of sulfited, dehydrated cabbage.

FENTON, F. *et al. Food Res., 11,* 475-485, Nov.-Dec. 1946.

The sulfited cabbage contained twice as much ascorbic acid as did the unsulfited cabbage of the previous test. The former contained about one-fourth as much thiamine as the latter, slightly more riboflavin and about the same amount of niacin. The retention of ascorbic acid in sulfited cabbage was 35% by the best method and only 22% by the best method in unsulfited cabbage. In general, the sulfited cabbage scored higher in color and texture than the unsulfited sample.

124G. Retention of vitamins and palatability in large-scale food service of unsulfited, dehydrated cabbage.

FENTON, F. *et al. Food Res., 11,* 468-474, Nov.-Dec. 1946.

The loss of ascorbic acid in cooked cabbage samples was marked, although cooking cabbage by adding it to the smallest amount of boiling water and boiling for a short time resulted in a greater percentage retention of each of the four vitamins than did cooking the cabbage by other methods. Coldslaw retained the highest percentage of ascorbic acid and had a higher palatability rating than the cooked cabbage samples.

125G. Effect of temperature and atmospheric humidity upon the behavior of dehydrated white potatoes in storage.

CULPEPPER, C. W., CALDWELL, J. S., AND WRIGHT, R. C. *Canner 104,* 14-20, Mar. 29; 15-8, April 3; 16-24, Apr. 12; 27-32, Apr. 19, 1947.

Four-part article covering most phases of the subject.

126G. Dehydration of precooked white potatoes in granular form.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. *Bibl. Sci. Ind. Reports, 4,* 951, (PB 58144), Mar. 14, 1947.

The present report, covering the period from July 1, 1944, through June 30, 1945, contains the results of studies made regarding the effects of various physical and chemical treatments of potato mashes on their subsequent drying characteristics, dehydration experiments carried out on industrial methods of dehydrating potatoes. Tables and diagrams of machines are included.

127G. Dehydration of precooked white potatoes in granular form.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. *Bibl. Sci. Ind. Reports, 4,* 952, (PB 58151), Mar. 14, 1947.

This report presents experimental procedure and results in determining the manner in which a slurry of cooked, mashed white potato and water might be made with the least damage to the potato cells. As a measure of the degree of cell damage, the viscosity of the potato slurry was determined by a modification of the method of Barker and Burton.

FATS AND OILS

128G. Flavor reversion in soybean oil.

GOLUMBIC, C., MARTIN, C. J., AND DAUBERT, B. F. *Manuf. Conf., 27,* 33-34, Mar. 1947.

It is evident that the oxidation rate of soybean oil may be varied over a considerable range without influencing the organoleptic evaluation of the degree of reversion. Even when the rate of oxidation is greatly reduced by the use of inert atmospheres, there is no diminution in the tendency to revert. On the contrary, with low oxygen concentrations, a type of reversion is produced that is more persistent in taste than that resulting in air or oxygen.

129G. A study of rancidity of olive oils.

KALOYEREAS, S. A. *J. Am. Oil Chem. Soc., 24,* 39-41, Feb. 1947.

An examination of the Kerr (oxidizability-value), Kreis (epihydrin-aldehyde), Fellenberg (peroxide and oxide) and Wheeler (iodimetric peroxide value) methods with organoleptic test for rancidity of olive oils indicated no one chemical test gives satisfactory results. Of the chemical methods, the Wheeler test for peroxides proved to be the most reliable for the examination of olive oil for rancidity. The Issoglio test, although of no value for testing rancidity, can be of use in differentiating the natural olive oils from refined olive oils. The susceptibility of the oil to oxidation was found to vary with the origin. Infestation of the olives by mold induces the susceptibility of the oils to rancidity. Alcoholic extracts of anise seed showed antioxidant properties. Negative results were obtained from alcoholic extracts of mustard seed.

FROZEN FOOD

130G. Suggested quality control program for frozen foods.

HALL, J. E. *West. Can. Pack., 39,* 67-69, Feb. 1947.

A comprehensive program of quality control is outlined covering field as well as plant work.

131G. Microbiological aspects of frozen precooked foods.

PROCTER, B. E., AND PHILLIPS, A. W. *Western Can. Pack., 39,* 84-85, Mar. 1947.

Many precooked frozen foods, on thawing, furnish excellent substrates for growth of microorganisms. Adequate refrigeration of frozen precooked foods is imperative. Data indicate not all frozen precooked food being sold has been subjected to constant or strict bacteria control. This is the only satisfactory way of determining quality standards of these products. Direct microscopic count was found of great value but should be supplemented occasionally by plate counts. Importance of extreme care during manufacturing, immediate freezing and continued storage at 0° F. or below is strongly recommended.

132G. Practical freezing techniques.

Quick Frozen Foods I-XVI, Mar. 1947.

Summary of series of articles dealing individually with the practical techniques of cultivation, harvesting, processing, packaging and freezing of important frozen foods. Included are asparagus, peas, corn, lima beans, spinach, broccoli, and shrimp, fillets and poultry.

133G. Effect of freezing storage on strawberries, blackberries, raspberries, and peaches.

WOODROOF, J. G., AND SHELOR, E. *Food Freezing, 2,* 206-209, Feb. 1947.

Desirable appearance, color, aroma, texture and flavor of strawberries were preserved much better at —10° F. than at higher temperatures, or at fluctuating temperatures. Strawberries were in better condition after 12 months storage at —10° F. than after 6 months at 10° F. All of the fruits deteriorated more rapidly at a temperature fluctuating from 0° to 10° F. than when held constant at 10° F. Blackberries and raspberries stored at —10° F. were superior to those stored at higher temperatures, but the differences were not as great as was found with strawberries and peaches. All samples of frozen blackberries and raspberries developed a semi-cooked aroma and flavor, and in blackberries alone there was a semi-cooked color.

134G. Retention of ascorbic acid in raspberries during freezing, frozen storage, puréeing, and manufacture into Velva fruit.

LOEFFLER, H. J. *Food Res., 11,* 507-515, Nov.-Dec. 1946.

Essentially all of the ascorbic acid was retained in raspberries during freezing and storage at —23° C. (—10° F.) for four months. However, raspberries lose their as-

corbic acid and titratable acidity if delay occurs between picking and freezing or if they are allowed to become overmature on the vine. Sugar is of value in retaining ascorbic acid in raspberry purée; however, the protective value of sugar was not found to be proportional to the concentrations of the sugars used in the syrups.

135G. Gaseous sulphur dioxide and sodium bisulphite as preservatives of citrus concentrates.

FEIGENBAUM, J., AND ISRAELASHVILI, S. *Nature, 159,* 32-33, Jan. 4, 1947.

Bisulphite appears to be 30-40% more efficient than sulphur dioxide in preserving 6:1 citrus concentrates. From 1000-1200 p.p.m. sodium bisulphide equivalent to 600-700 p.p.m. SO_2 is required or 800-1000 p.p.m. of SO_2 itself is used. Less than 1,000 p.p.m. SO_2 allows darkening of the product. Apparently more preservative is required to prevent color changes than is necessary to give microbiological protection.

136G. Studies of methods of vegetable blanching. Part VI.

WOODROOF, J. G. *et al. Quick Frozen Foods, 9,* 74-75, Jan. 1947.

Various methods of scalding corn on the cob, okra, and onions were tried, and samples examined after six months and one year storage. The methods, such as atmospheric steam, steam under pressure, hot water were evaluated for each product, and results tabulated according to preference. Live steam, for different times, is preferred for all three.

137G. The effect of various methods of blanching on ascorbic acid and soluble solids in cauliflower and spinach.

KALOYEREAS, S. A. *Fruit Prod., 26,* 134-135, Jan. 1947.

Blanching of vegetables for freezing causes considerable losses in nutritive value and impairs the texture and crispness of the product. Therefore methods employing dielectric heat, dipping of product in solutions of SO_2 or Na_2SO_3, quick freezing in an alcohol-dry ice mixture at —85° and dipping in pectin solution were attempted to avoid as much as possible oxidation and loss by solution into the blanching liquid, and also to speed the freezing process to such an extent as to counteract the necessity of blanching.

138G. Freezing of unscalded vegetables a futile processing gesture.

GEORGIA EXPT. STA. *Canner, 104,* 37, March 1, 1947.

Recent experiments at the Georgia Experiment Station indicate that the six methods of heating vegetables prior to freezing in the order of their importance are: live steam, hot water, steam pressure, electronic heating, infrared light and ultraviolet. Since flavors developed by cooking are more readily lost during freezing storage than flavors of the uncooked blanched product, cooking prior to freezing is not recommended, except for combination dishes with flavors greatly enhanced by added materials.

139G. The effect of premortal fast on deterioration of frozen poultry.

WAGONER, C. E., VAIL, G. E., AND CONRAD, R. M. *Poultry Sci., 26,* 167-169, Mar. 1947.

Starving poultry for 16 hours before slaughter tends to increase the storage stability slightly but significantly. No difference was found in the extent of fat oxidation. The starved birds were found to contain fat of greater acidity, and it is suggested that this difference may be due to phospholipids rather than to free fatty acids.

140G. The influence of preliminary holding conditions on deterioration of frozen poultry.

WAGONER, C. E., VAIL, G. E., AND CONRAD, R. M. *Poultry Sci., 26,* 170-172, Mar. 1947.

Holding dressed poultry at chill room temperatures for one day or longer before evisceration and freezing decreases the stability of the poultry in frozen storage. Freezing and thawing the birds before evisceration likewise decreases the stability in subsequent frozen storage by increasing the susceptibility to rancidity.

141G. Odor removal studies in refrigerated storage.

SMOCK, R. M., AND UOTA, M. *Refrig. Res. Found., Bull.* No. 47-1, Jan. 20, 1947.

Air purification with activated carbon is still best way to remove such odors as apples, pine wood, onions, cabbage, potatoes and eggs. Ozone is not effective in most instances. Ceric sulfate was used to measure onion aroma.

FRUIT AND FRUIT JUICES

142G. Ascorbic acid added to apple, grape and cranberry juices is found stable.

ESSELEN, W. B., POWERS, J. J., AND FELLERS, C. R. *Food Field Rep., 15,* 53, Feb. 17, 1947.

Ascorbic acid added to apple, cranberry and grape juices is stable, and has a favorable effect on color retention during storage. It may be possible to provide apple, cranberry and grape juices with as much vitamin C as

the canned citrus juices by fortification with crystalline ascorbic acid.

143G. Phosphatase activity as an index of pasteurization in citrus juices.

AXELROD, B. *Fruit Prod., 26,* 132-133, Jan. 1947.

The enzyme, phosphatase, recently found in Valencia and Washington Navel oranges, the Eureka lemon and the Marsh seedless grapefruit, upon experiment showed, that when the juice was maintained at a given pH, heat inactivated the enzyme but when the pH was increased the enzyme showed a pronounced decrease in sensitivity to heat. Complete inactivation was accomplished in every case but the duration of heat applied varied with the sample. The method of measurement of the phosphatase is simple and rapid and its use as an indicator of pasteurization is a possibility depending on the process used.

144G. Studies on storage of dried fruit.

BARGER, W. R., AND PENTZER, E. T. *Refrig. Res. Found., Bull.* 47-1, Jan. 20, 1947.

Important storage defects of dried fruit were browning of fruits such as apricots, peaches, apples, pears and figs and sugaring of raisins, figs and prunes. Mold was a factor in storage of dried fruit even at 40° F. with humidities high enough to cause weight gain. Cold storage temps. of 32-40° F. prevented insect damage and slowly reduced infestation. Flavor, appearance and ascorbic acid were retained best at 32-40°, texture was affected by humidity, low humidity causing fruit to become tough and chewy. Carotene retained well in storage, over at high temp. —32° F. and 55% r. h. good storage conditions. All fruits stored better at moist contents less than allowed by grade standards.

145G. Factors influencing the volatile oil content of the peel of immature and mature orange.

BARTHOLOMEW, E. T., AND SINCLAIR, W. B. *Plant Physiol., 21,* 319-331 (1946); *Biol. Abst., 21,* 194, No. 1738, Jan. 1947.

The yield of oil per unit area from Valencia and Navel orange peel shows very little change from the time the fruit is half grown until it is mature, but the yield per fruit increases in proportion to the increase in surface area of the peel. After the fruits have reached maturity, the oil content of the peel appears to be governed more by climatic and physiol. conditions than by any change in the surface area of the fruit. The oil content of the peel of both Valencias and Navels is highest in the fruits from the inland districts and progressively lower in those from nearer the coast. Large fruits yield more oil than small fruits when expressed as yield per surface area, but the reverse is true when the yield is expressed on a tonnage basis, because small fruits have more surface area per ton.

146G. Dissolution of substance of teeth by lemon juice.

Proc. Staff Meet., Mayo Clin., 22:81 (1947); *J. Am. Med. Assoc., 133,* 1218, Apr. 19, 1947.

Fifty patients who were using lemon juice routinely showed evidence of dissolution of dental structure. In view of this harmful effect on teeth, the use of lemon juice as a daily drink in any appreciable concentrations should be discouraged.

147G. Citrus industry questions Mayo charges on lemons.

STREIB, R. B. *Food Field Rep., 15,* 60, May 12, 1947.

The recent charges made by two Mayo Clinic physicians that lemon juice may cause erosion of the teeth are being contested by a number of segments of the citrus fruit industry. They point out that there is no evidence on what percentage of lemon juice drinkers show erosion of the teeth. The Mayo study covers only 50 patients while it is estimated over 12,000,000 people drink lemon juice and water regularly. Dentists have never reported evidence that lemon juice might cause such injury to teeth.

MEAT AND POULTRY

148G. Effect of cooking on meat.

BENDALL, J. R. *Food Manuf., 22,* 58, Feb. 1947.

It was found that the principal changes in creatinine, phosphorus compounds, and non-protein nitrogen, occurring when raw minced lean beef was (a) cooked at 100° C. for one hour, (b) pressure cooked at 126° C. for three hours, were as follows: creatinine, the ratio of free to total creatinine increased from 2.1% to 44% in (a) and to 85% in (b) i.e. there was a large conversion of creatine to creatinine. Phosphorus compounds. In (a) the relative amounts of the various phosphorus fractions were little altered, but in (b) total soluble phosphorus and inorganic phosphorus were markedly increased, and organic phosphorus (hexosediphosphate, adenylic acid, and unidentified phosphorus) was correspondingly decreased. Non-protein nitrogen. In (a) there was no significant increase in dialysable nitrogen and non-coaguable nitrogen, but in (b) these fractions increased by 51 and 58% respectively of the

raw values. These changes were thought to be associated with the development of bitterness and hydrogen sulphide flavour in pressure-cooked meat.

149G. Studies of feed efficiency. 1. The relative efficiency of corn and wheat products in chick rations.

CARRICK, C. W., AND ROBERTS, R. E. *Poultry Sci., 26,* 111-117, Mar. 1947.

When 10% each wheat bran and wheat middlings replaced 20% ground yellow corn in a ration known to give rapid growth, more feed was required per unit of gain than when the wheat products were not included. The use of the wheat products reduced the rate of growth obtained from the type of ration used. The feed consumption per chick was greater for the lots fed on the wheat products ration than for those fed on the corn ration.

MILK AND DAIRY PRODUCTS

150G. Dried eggs improve ice cream.

FRISCHKNECHT, C. *Ice Cream Field,* May, 1946; *U. S. Egg Poultry Mag., 53,* 22, Apr. 1947.

Taste panel tests were conducted by government agencies in Washington to determine consumer acceptance of ice cream containing different amounts of dried whole eggs, varying from 0 to 5%. The results indicate that 1 or 2% of dried whole eggs may be added successfully to vanilla ice cream. The addition of 3 and 4% dried whole eggs resulted in a slightly less acceptable product, whereas 5% was not recommended. No difficulty was experienced in processing or freezing any of the mixes.

151G. Analysis of stabilizers.

DAHLE, C. D. *Ice Cream Field, 48,* 62, Oct. 1946; *J. Dairy Sci., 19,* A21, Feb. 1947.

Gelatin, sodium alginate, locust bean (carob gum), Irish moss, sodium carboxymethyl cellulose, oatgum, pectin, Karaya, and Psyllium seed husks (ground) as stabilizers in ice cream are discussed. Because of the shortage of certain stabilizers during the war, several "mixed" stabilizers were placed on the market. These often contain various sugars which aid in dispersing the stabilizing agent and also may contain one or more of the following: sodium bicarbonate, sodium citrate, whey powder, milk solids dextrines, and, possibly, emulsifying agents. Emulsifying agents such as glycerol monostearate, sodium mono-palmitate, and sorbitan monostearate are mentioned briefly as aids to the whipping ability of ice cream mixes.

PECTIN-JAMS AND JELLIES

152G. Storage behavior of fruit spreads.

KERTESZ, Z. I. *Glass Packer, 26,* 208-209, Mar. 1947.

Studies to date on the deterioration of fruit spreads with time indicate that temperature is an important factor in spoilage, the loss in color of strawberry preserves at 100° F. being roughly 8 times greater than at 60° F. It has been found that color change precedes flavor change and future work by the National Preserves Association will be concentrated on setting up standards for the measurement of this color change.

153G. Process for preparing pectinates.

BRYANT, E. F. 2,418,866, Apr. 15, 1947.

A process for the preparation of an alkaline earth pectinate comprising suspending pectin having a methoxyl content below about 8%—OCH_3 in a liquid medium incapable of hydrating the pectin to any substantial degree but capable of dissolving an effective amount of an alkaline earth salt, adding to the suspension a water soluble, alcohol soluble alkaline earth salt in an amount sufficient to form a corresponding water insoluble pectinate, and separating the pectinate from the liquid medium.

154G. Process for preparing pectinates.

BRYANT, E. F. 2,418,865, Apr. 15, 1947.

A process for the preparation of pectinates comprising suspending pectin having a methoxyl content of from 8 to 11% in a liquid medium incapable of hydrating the pectin to any substantial degree but capable of dissolving an effective amount of an alkalizing reagent, adding to the suspension of pectin an alkalizing reagent in an amount sufficient to partially demethoxylate the pectin to form a water soluble pectinate, adding a water soluble, alcohol soluble alkaline earth salt to the suspension of pectinate in an amount sufficient to form a water insoluble pectinate, and separating the so formed pectinate from the liquid medium.

SALT

155G. Flavor pays dividends.

TUSTIN, E. B. *Canning Tr., 69,* 48, Jan. 6, 1947.

Since salt brings out the natural characteristic flavors of food, and our ability to taste flavors is accentuated. As the proportion of salt is increased, as much salt as possible should be used up to just short of the point where it can be tasted.

156G. Goiter not iodine lack.

Sci. N. L., 51, 86, Feb. 8, 1947.

According to Dr. Isidor Greenwald of New York University College of Medicine, endemic goiter is not caused by a lack of iodine in the diet. He bases his conclusion on the fact that goiterous thyroid glands contain more iodine than normal glands. Also the incidence of goiter has not been reduced to zero in goiter belts by the addition of iodine to table salt. Goiter was unknown among the Indians of the Great Lakes goiter belt.

157G. Iodized salt and goiter.

J. Am. Med. Assoc., 133, 620, Mar. 1, 1947.

The Council on Foods and Nutrition of the A. M. A. believes that adequate legislation should be passed requiring the addition of not more than 1 part of sodium iodide or the iodine equivalent to 5,000 parts of salt. The announcement circulated through Science Service by Dr. Isodor Greenwald, that iodine deficiency is not related to the causation of simple goiter, has been refuted by the A. M. A.

158G. Bill to amend Federal Food, Drug, and Cosmetic Act.

Food, Drug, Cosmetic Law Report, No. 6, 3, Mar. 31, 1947.

A bill has been introduced in the House of Representatives (H. R. 2717) for the purpose of amending Section 301 of the Federal Food, Drug, and Cosmetic Act so as to prohibit the introduction into interstate commerce of salt for table use unless it contains suitable iodides in a quantity equivalent to not less than 80 parts and not more than 160 parts of iodine per million parts of such salt.

159G. Britain is slow in adopting a standard iodized salt.

Manuf. Chemist, 17, 436-437, Oct. 1946.

The war-time shortage of fish in Britain prompted the British government to set a minimum standard for iodine consumption. Disregarding any fear of iodine-induced hyperthyroidism, it is recommended that the whole of the country's domestic salt supply (i.e., cooking salt, table salt, and salt used in food manufacture) should be fortified with KI in the proportion of 1 part of iodine to 100,000 parts of salt.

SUGARS, STARCHES AND SYRUPS

160G. Recording viscometer for starches.

Kesler, C. C., and Bechtel, W. G. *Anal. Chem., 19,* 16-21, Jan. 1947.

A continuous recording viscometer for routine and research testing of starch products is described. Variations in cooking procedures which cause errors in viscoscity determinations are prevented through automatic control of rate of heating, maximum temperature, rate of stirring, and loss of water by evaporation. Viscosity is measured as the force which the paste exerts against a propeller driven through it at constant speed. A gear differential transmits the force to a dynamometer attached to the pen arm of the recorder. Interchangeable weights on the dynamometer permit measurements in several viscosity ranges with equal sensitivity and without requiring recalibration of the viscometer. Starches from different sources and of different kinds and degrees of modification give characteristically different curves which are of value in their identification and study.

161G. New benzene derivative seen as sugar substitute.

Verkade, P. E. *Northw. Miller, 229,* 49, Feb. 4, 1947.

4000 times as sweet as cane sugar, the product, 1-n-propoxy-2-amino-4-nitrobenzene, is now being manufactured on a fairly large scale in Zaandam, Holland.

162G. Factors causing dark-colored maple syrup.

Hayward, F. W., and Pederson, C. S. *N. Y. State Ag. Expt. Sta. Bull. No. 718,* (1946); *Food Pack., 28,* 86, Feb. 1947.

Light colored maple syrup usually has better flavor than dark colored syrup. Color depends on alkalinity of sap and invert sugar content. Extent of color development is limited by care of either factor and is accompanied by decrease in alkalinity and destruction of reducing sugar. Growth of bacteria causes increase in alkalinity and inversion of sucrose.

163G. Caramel, flavor and color.

Jacobs, M. B. *Am. Perf., 49,* 45-46, Jan. 1947.

Preparation, properties and available chemical knowledge of caramel. The article mentions dehydration, polymerization, formation of insolubles, and catalytic influence of alkali.

VEGETABLES

164G. Warding off frost damage with radiant energy.

Michigan State College. *Canner, 104,* 11-12, Apr. 5, 1947.

An infrared heat radiating device was built, consisting essentially of an aluminum reflector with specially treated surface of proper shape to distribute the energy over a given area and a rod-type chromolox electric heating element so positioned as to focus the radiant energy over the prescribed area. The

unit was connected to a standard 3-phase 440-volt alternating current line. The radiation unit was built up in sections and so positioned over the area to be protected that the prescribed area of 1600 square feet could be covered. Several new designs will be tested on Michigan farms to determine the most efficient model for various crops.

165G. Palatability and ascorbic acid retention of rutabaga, peas, and cabbage after holding on the steam table.

KELLEY, L. *et al. J. Am. Diet. Assoc., 23,* 120-124, Feb., 1947.

Eighteen replications each of rutabagas, fresh green peas, and winter cabbage were cooked and analyzed for total ascorbic acid after 0, 15, 30 and 60 minutes on a steam table. Steam table temperatures were maintained at 90° C. and 100° C. in two series of nine replications each. The temperature of the steam table and holding time were found to be the two factors causing consistent destruction of ascorbic acid.

166G. The vitamin content of soybeans and soybean sprouts as a function of germination time.

WAI, K. N. T. *et al. Plant Physiol., 22,* 117-126, Apr. 1947.

Assays for carotene, thiamin, riboflavin, niacin, and reduced and dehydro ascorbic acid were made on dry Bansei soybeans, and on the soybeans after controlled soaking and germination periods. The quantity of all vitamins studied except thiamin showed increases through 54 hours of germination, the period at which the product exhibited its optimum organoleptic properties. Thiamin showed alternate increases and decreases throughout the germination period investigated.

167G. Have the food industries neglected the white potato?

FYFER, H. *Food Mat. Equip., 7, 10,* Mar. 1947.

White potatoes are an important source of vitamin C, and can supply 1/3 the daily requirement in one serving. It is a good source of B_1 as well. Both of these vitamins are present close to the peel, and they are transferred to the interior when potatoes are cooked in the jackets. The mineral values of potato are the iron and copper.

168G. Partial characterization of a compound involved in the blackening of white potatoes.

LEWIS, W. R., AND DOTY, D. M. *J. Am. Chem. Soc., 69,* 521-523, Mar. 1947.

A colorless precursor of the pigment which causes some white potatoes to turn grey or black when they are cooked has been isolated. The fluorescent pigment precursor is unsaturated, and contains a carbohydrate group and a nitrogenous group. The latter is probably an amino acid or a peptide. Tyrosine and trytophan are not contained in the fluorescent pigment precursor. The absorption curve of the precursor shows a maximum at 2800 A.

169G. Blackening indices of potatoes grown under various conditions of field culture.

TOTTINGHAM, W. E. *et al. J. Agr. Res., 74,* 145-163, Mar. 1, 1947.

The tests, covering field trials over a period of 9 years, were designed to ascertain the influence of climatic and cultural conditions and potato varieties on the blackening of potatoes after boiling. By extending the trials over a number of years at several stations a variety of soil types and climatic conditions were encountered, and it was possible to test numerous potato varieties and strains and to employ a number of different fertilizer treatments. These tests show no single factor or combination of factors to be uniformly responsible for blackening of potatoes on boiling; rather, they emphasize the complexity of the factors governing this response of tubers.

170G. Peanuts and peanut products.

WOODROOF, J. G. *Refrig. Res. Found., Bull.* No. 47-1, Jan. 20, 1947.

Peanuts and peanut products are perishable food and should be stored and transported as such. Refrigerated transit and storage solves major problems by (1) preventing insect infestation, (2) preventing oil separation in peanut butter, (3) extending period before staleness or rancidity is noticeable, (4) retaining a better color and, (5) retarding absorption of peanut oil by containers, wrappers or adjacent products.

171G. Utilizing vegetable wastes.

HOWARD, L. B. *Canning Tr., 69,* 7, Apr. 7, 1947.

In considering how vegetable wastes might be utilized on a commercial scale, USDA has made studies to determine (1) how much of various kinds of waste is available, (2) which production areas offer the best supply sources, and (3) the seasonal yields of various types of wastes in each production area. Leafy wastes offering the greatest returns (because of their nutritive value and the quantity grown) include beets, broccoli, cabbage, carrots, cauliflower, kale, lima beans, peas, rutabagas, spinach, tomatoes, and turnips. Tomato leaves cannot be used to produce leaf meal,

but their suitability for use in manufacturing animal feed more than makes up for this inadequacy.

INDUSTRIAL CHEMISTRY

172G. How American Cyanamid handles its research reports.

JOHNSON, H. C. E. *Chem. Ind., 60,* 217-218, Feb. 1947.

In a large research organization, where research reports are numerous and filing problems are thereby multiplied, it is preferable that reports be written when progress dictates rather than at arbitrary intervals. Flexible, and serving to exclude incomplete or repetitive information from the files, the system embodies points of interest and usefulness to smaller organizations as well.

173G. How to work out a sanitation program in a food plant.

BARRON, J. L. *Food Ind., 19,* 170-171, Feb. 1947.

Methods of working out a sanitation program for a food plant are discussed. This article will be of value to plant engineers desiring to institute such a program.

174G. Aerosol technique provides plant-scale insect control.

BARNES, E. C. *et al. Chem. Ind., 60,* 238-240, Feb. 1947.

Insecticidal aerosols have attained prominence in recent years as a means of exterminating flying pests in the household, but the possibility that they might be employed to effect similar control in large buildings, such as factories, had not been investigated before the work described here was undertaken. The satisfactory results obtained by the use of the technique developed by the authors may well lead to broader utilization of aerosols in food processing plants, laundries, and other factories.

175G. River reaeration.

WILEY, A. J. *et al. Paper Tr. J., 124,* 59-64, Mar. 20, 1947.

A method suggested by Prof. Tyler of the University of Washington consisting of diffusing compressed air beneath the surface of a river which has been polluted for the purpose of maintaining minimum levels of dissolved oxygen, has been tried in full scale on a Wisconsin river. The process appears to be a useful tool in accelerating the recovery of a polluted stream shortening to a considerable degree the distance of passage required for oxidation of the waste and serves to prevent anaerobic conditions and attending nuisance. Extensive test data collected during operation of the unit are summarized in this paper including biological observations with respect to stream flora and fauna. Recommendations with respect to application, requirements, design, and efficiency are included.

NUTRITION

176G. A preliminary report of the "folic acid" content of certain foods.

OLSON, O. E., BURRIS, R. H., AND ELVEHJEM, C. A. *J. Am. Diet. Assoc., 23,* 200-203, Mar. 1947.

Folic acid content of several vegetables, meats and canned foods may be classified as follows: very high-fresh deep green leafy vegetables, liver; high-fresh green vegetables, cauliflower, kidney; medium-beef, veal, dry breakfast cereals prepared from wheat; low-root vegetables, tomatoes, cucumbers, light green leafy vegetables, bananas, pork, ham, lamb, cheese, milk, dry breakfast cereals prepared from rice or corn, and many canned foods.

177G. Present knowledge of vitamin D in nutrition.

Nutr. Revs., 5, 35-37, Feb. 1947.

The two most important vitamins D for nutritional purposes are D_2 (activated ergosterol, calciferol, viosterol) and vitamin D_3 (activated 7-dehydrochloesterol). The suggested daily allowance of the vitamin is 400 I. U. Too large a dose can be toxic resulting in an abnormally high level of calcium in the serum and overcalcification.

178G. Toxicity of the vitamins.

Nutr. Revs., 5, 49-50, Feb. 1947.

The LD_{50} of niacin was about 5 gr. per kilogram of body weight. Nicotinamide was three times, pyridine five times and coramine was twenty-one times as toxic as niacin. Thiamin is more toxic than niacin while pyrodoxine has about the same toxicity. No evidence is given that riboflavin, pantothenic acid, para-aminobenzoic acid, or ascorbic acid produce toxic effects when given in large doses. However, ascorbic acid does produce a diuresis in humans not due to acidification. Excessive ingestion of vitamin A produces retarded growth, rarefaction of bones, exopthalmos, and subcutaneous and intramuscular hemorrhages when given to the extent of 530,000 I. U. per kilogram of body weight per day. Vitamin D in doses of greater than 20,000 I. U. per kilogram of body weight per day causes loss of weight, diarrhea, vomiting, signs of renal damage, increased serum calcium, and calcified areas in the viscera. Since the ratio between daily

requirements of vitamins and the toxic dose of the vitamin varies from 1:600 to 1:60,000, vitamins in general are quite nontoxic.

179G. Review of disturbances of fat absorption and fat digestion.

KIRSCHEN, M. M., AND WEINBERG, B. J. *Am. J. Digestive Diseases, 14,* 30-35, Jan. 1947.

The review discussed the relation of fat to nutrition, the disturbance of fat digestion and absorption, and its physiological consequences.

180G. Influence of nonfat dry milk solids on the nutritive value of bread.

RIGGS, L. K., BEATTY, A., AND JOHNSON, A. H. *J. Dairy Sci., 29,* 821-829, Dec. 1946.

The addition of 6% nonfat dry milk solids improves the nutritive value of water bread, enriched water bread and whole wheat bread. Water bread supplemented with 6% nonfat dry milk solids is superior in nutritive value to enriched water bread as measured by the grams of solids required to produce a gram of gain and the per cent nitrogen and calcium in the carcasses of the experimental animals. There was no significant difference between hemoglobin levels in the rats on which these comparisons were made.

PACKAGING

181G. Moisture equilibrium.

FUNK, W. A. *Mod. Pack., 20,* 135-138, Feb. 1947.

The facts concerning the humidity equilibrium characteristics of a product are essential to determinations of the proper package. This article describes a practical and convenient method of determining humidity equilibrium characteristics of many materials and it should be particularly useful for laboratories interested in rapidly evaluating a large number of products to be packaged.

182G. Drop test.

PACKAGING INSTITUTE. *Mod. Pack., 20,* 144, Feb. 1947.

A Packaging Institute Standard test method for determining the durability of a material to a particular kind of shock is described.

183G. Adhesives — major market for food materials. II. Casein adhesives.

FRIEDEN, A. *Food Mat. Equip., 7,* 18, Jan. 1947.

Detailed methods for the preparation of both water resistant and non-water resistant casein adhesives are described. Methods for making both types with certain specific properties, as well as the uses for each type of glue are given.

184G. Freezer wraps.

MCCOY, D. C., COOK, S. V., AND HAYNER, G. A. *Mod. Pack., 20,* 188-192, Mar. 1947.

Many factors to take into account in considering freezer wrappers. Of 32 wrappers tested in this study, duPont's 300 MSAT-83 cellophane was best.

185G. Wrapping materials for frozen meats and chickens.

WOODROOF, J. G., ATKINSON, I., AND SHELOR, E. *Food Freezing, 2,* 274-277, Mar. 1947.

Aluminum foil adequately protected poultry from desiccation and loss of aroma and flavor for at least one year. By using cellophane as a wrapper, the desirability was lowered approximately 25% and locker paper about 50%. Frozen poultry remained in excellent condition for a year if prevented from desiccating. As the moisture loss increased, pockmarks and freezer burn on the skin increased making it hard and dry, the skin yellowed increasingly, the meat portion darkened and became drier, and the fresh flavor was replaced by a stale flavor.

186G. New process packs frozen foods in cellophane, 40 bags a minute.

Ice Refrig., 112, 66, Mar., 1947.

The machine automatically forms cellophane bags, fills the bags with frozen products, exhausts most of the air from them and heat-seals the bags, all in one operation. One operator is needed to run the new "Transwrap." Hands do not touch the food at any step. Free-flowing vegetables such as lima beans, diced carrots, peas, combinations of carrots and peas, cut corn, succotash, and mixed products can be successfully packaged by the process. They may be frozen first and then packaged in the "Transwrap" machines, or wrapped fresh and then frozen within their cellophane bags.

News of the Institute

Regional Section News

GREAT LAKES SECTION

Dr. C. Olin Ball, immediate past-chairman of the Great Lakes Section, has been retained as a consultant and a member of the Board of Directors of The United Company and The United Products Company, Westminster, Maryland.

Lewis J. Minor, formerly of Toledo, is now associated with the Huron Milling Company at Harbor Beach, Michigan. "Lou" is one of the more dependable workers in the Section, which is consequently happy to have him remain within its boundaries.

Students majoring in Food Technology at Michigan State College expect to form a professional club soon after the opening of the Fall Quarter.

The Section has been fortunate in arranging to hold two of its meetings in the beautiful building of the Engineering Society of Detroit, at 100 Farnsworth Avenue. This building provides excellent rooms for meetings, dining facilities, and lounging. The dates for these meetings are November 21 and January 16. Three papers will be presented at afternoon sessions on these dates, followed by dinner and an after-dinner paper.

MARYLAND SECTION

The Maryland Section has held monthly dinner meetings in 1947, with from 50 to 70 technologists attending the meetings. A wide range of subjects has been covered by the speakers at these meetings.

At the January Meeting, Mrs. E. V. McCollum of Johns Hopkins University, spoke on the Newer Knowledge of Nutrition.

In February Dr. Hucker, then Secretary Treasurer of the Institute, presented an address on Quaternary Ammonium Compounds and Dr. Lee of New York State Experiment Station spoke on Freezing of Vegetable Products.

The March meeting was addressed by Dr. A. G. Olsen of the General Foods Central Laboratories who presented Mr. T. M. Rector's paper on "What General Management should know about Research & Development."

In April Dr. D. V. Josephson of Ohio State University was the speaker with his subject "Recent Developments in Judging Flavor in Food Products."

At the May meeting Dr. N. C. Laffer of the University of Maryland talked on the subject "Micro-organisms in Food Products."

The June meeting was a special occasion with a tour of the flour mill, cereal mix plant and laboratories of the Doughnut Corporation at Ellicott City followed by a symposium presented by the Staff of the Doughnut Corporation dealing with shortening performance and flour mill practices.

A number of members of the Maryland Section attended the National Meeting in Boston in June.

The meetings are held at the Stafford Hotel in Baltimore and Food Technologists in Maryland and the District of Columbia who are not at present receiving notices of meetings are invited to communicate with the Secretary, Mr. B. W. Clarke, c/o Crosse & Blackwell Company, 6801 Eastern Avenue, Baltimore 24, Maryland.

Other officers of the section are:

Chairman—Dr. A. H. Johnson, National Dairy Products Research Laboratory, Baltimore, Maryland.

Vice-Chairman—Mr. S. W. Arenson, Doughnut Corporation of America, Ellicott City, Baltimore, Maryland.

Treasurer—Mr. M. Siegel, 15 S. Gay Street, Baltimore, Maryland.

NORTHERN CALIFORNIA SECTION

On June 19, in San Francisco, members of this Section heard a talk on "Nutrition" by Dr. J. Russell Esty of the National Canners Association and a talk on "Color Retention in Processed Foods" by Dr. Gordon Mackinney of the University of California.

The position of Advertising Manager of the I. F. T. Hornblower has now been filled by Harold E. Jahn.

New members of the Northern California Section have been elected as follows: Robert A. Stewart of Western Frozen Foods, Elberton B. Stark, Editor of the Western Canner and Packer, and Dr. Walter L. Dunkley.

Plans are well under way for the National Meeting to be held in California in 1949.

Sam Lepkovsky has returned from Europe where he was studying malnutrition.

Dr. Maynard A. Joslyn of the Food Technology Division, University of California, was married in April to Dr. Golda Fisher of the Children's Hospital, San Francisco.

Emil Mrak and Dr. George Stewart (of Iowa State College) have assumed editorial responsibility for a new annual publication, to be called "Advances in Food Research." It is planned for this publication to present critical and exhaustive reviews on food research, both functional and commodity food research, by competent specialists.

On August 21 in San Francisco, Dr. Otto Rahn of Cornell University spoke to members of the Section on "Quaternary Ammonium Compounds as Disinfectants."

Plans for the October meeting to be held jointly with the Southern California Section on October 24 and 25 include the following papers:

Chemical Studies on Flavors. A. J. Haagen-Smit, California Institute of Technology.

Considerations in determination of processes for foods packaged in glass containers. Charles T. Townsend of N. C. A.

Products and By-Products of the Fishing Industry. Sven Lassen, Van Camp Sea Food Co.

Recent Advances in Nutrition. Sam Lepkovsky, University of California.

Program of Western Regional Research Laboratory. M. J. Copley of the same laboratory.

Proteins and amino acids in the food industry. M. S. Dunn, University of California, Los Angeles.

Enzyme Problems in the Citrus Industry. A. K. Balls, U. S. Department of Agriculture.

Identification badges, circular in shape and about 3½ inches in diameter, made their appearance at the June 19 meeting. The badge bears the label, "INSTITUTE

OF FOOD TECHNOLOGISTS, NORTHERN CALIFORNIA SECTION," in the upper half of the circle, the member's name in the center, and a drawing of the horn of plenty in the lower section. These badges are to be given out by the Reception Committee at the beginning and collected at the end of each meeting. This Committee will take charge of the badges between meetings.

E. L. Jack has been appointed head of the Dairy Industry Division at the University of California, at Davis.

The following names were approved for Section membership and recommended for full membership in the National: Arne Erickson, Robert G. Ramsey, and Olga Fekula. The following were elected to membership in the Section and recommended for Affiliate in the National: Marshall Taft, Robert Stewart, Bruno Filice, and Joseph Powers. The following were elected to limited membership in the local section: Ahmed Mohamed El Tabey, Harold Roshoff, and Don Swenson (son).

PHILADELPHIA SECTION

On July 28, there was a meeting of the officers of the Convention Committee preparing for the next annual meeting of the Institute of Food Technology to be held in Philadelphia in June, 1948.

The first fall meeting of the Section was held at the University of Delaware in Newark, Delaware, on October 9. The speaker was Mr. Lee Towson of the Glen-Mar Farms of Chestertown, Maryland. He described the Glen-Mar system of preparing fruits and vegetables for air shipment and cool-storage marketing. The meeting was open to wives and friends of members of the Section.

PUGET SOUND SECTION

On June 19, the final spring meeting of the Puget Sound Section was held at Johnson Hall, University of Washington. Election of officers was made as follows: Chairman, L. P. Callahan; Vice-Chairman, C. W. Anderson; Secretary, N. J. Willett; Treasurer, A. J. King; Section Councilor, J. E. Hall; Executive Committee (2 years), E. D. Clark and Francis Owens; Executive Committee (1 year), C. W. Hurlbut and A. O. Dahlberg.

Mr. Kenneth Monfore, Chief of the Seattle Office of the U. S. Food and Drug Administration, addressed the meeting on the subject "Work of the Federal Food and Drug Administration Involving Food Technology." Mr. Monfore stressed the need for a Federal Agency such as the U. S. Food and Drug Administration, pointing out that this agency benefits primarily the ultimate consumer but, in so doing, also benefits industry by regulating identity and quality of food and drug products. Growth of the agency was outlined, including the following important steps: (1) The 1930 McNary Mapes Law which served as a guide in place of the "opinions" used prior to that time, and (2) The Federal Food, Drug and Cosmetic Act of June 25, 1938, which established clearly defined regulations for these products and served as a basis for promulgation of Standards of Identity, Quality, and Fill of Container for many items. Discussion presented by Mr. Monfore during his address and questions asked by members following the address brought out illustrations of Food and Drug Department activities in connection with the milling, canning, and spice production industries. In these discussions it was emphasized that if a product does not conform in all details with the U. S. Standards of Identity for that product, it cannot be legally merchandised under the product name.

Mr. L. P. Callahan, of Libby's Seattle Laboratory, has been in Alaska since the latter part of June working on technical problems in the production of canned salmon. He returned to Seattle early in September.

Dr. R. W. Clough, of the National Canners' Association Seattle Laboratory, has recently returned from a trip to Washington, D. C., where he testified at a U. S. Food and Drug hearing to establish fill of container standards for canned oysters. Dr. Clough presented factual data collected on fill of container for processed Pacific oysters.

NEW YORK SECTION

For the coming year, the New York Section has planned meetings to be held the third Wednesday of each month, October through May (with the exception of December), at The Building Trades Employer's Association, 2 Park Avenue, New York City, at 6:30 p. m.

At the first meeting, on October 15, Dr. J. P. Kass addressed the Section on "New Type Emulsifiers."

Selected Abstracts

ANALYTICAL CHEMISTRY

187G. Some applications of electrometric methods in analysis.

CARTER, R. J. *Analyst, 72,* 94-9, Mar. 1947.

A general discussion of potentiometric titrations of the acid-alkali, precipitation, and oxidation-reduction types. The mechanism and application of the electrometric Karl Fischer method are described in some detail. A good bibliography is appended.

188G. New pH indicators for determination of total alkalinity in water.

TARAS, M. *Anal. Chem., 19,* 339-41, May 1947.

The preparation and use of two new indicators of the diazostilbeneaminedisulfate series are described. Both are effective in the pH range 4.0 to 5.0; one is especially useful in colored solutions.

189G. The determination of tin in canned goods.

DICKINSON, D. *Ann. Rept. Fruit and Vegetable Preservation Res. Sta. Campden* 46-52 (1944); *Biol. Abst. 21,* 573, No. 5547, Mar. 1947.

A colorimetric method is given for a rapid and routinely accurate determination of tin in canned goods; SnO in the ashed sample is reduced to metal by fusion with KCN; the melt is dissolved in acid, filtered, and to an aliquot a solution of dithiol is added which forms a red compound with Sn.

190G. Tetraethylenepentamine as a colorimetric reagent for copper.

CRUMPLER, T. B. *Anal. Chem., 19,* 325-6, May 1947.

Tetraethylenepentamine is used as a colorimetric reagent for copper in cases where quantities of copper up to 200 p.p.m. are to be measured.

191G. Colorimetric determination of sulfur dioxide.

GRANT, W. M. *Anal. Chem., 19,* 345-6, May 1947.

A colorimetric method for determining sulfur dioxide in alkaline extracts of animal tissues or in distillates from fruits is based on the reaction of sulfur dioxide with fuchsin and formaldehyde.

192G. An electrometric indicator to replace starch in iodine titrations of sulphurous acid in fruit juices.

INGRAM, M. *J. Soc. Chem. Ind., 66,* 50-4, Feb. 1947.

A bright platinum electrode, used in conjunction with a simple reference electrode and electrometer, is an effective substitute for starch in iodometric titrations of fruit juices. The error in the determination is five times smaller than with starch and endpoints can be observed equally well in highly colored juices in which starch cannot be used.

193G. A new specific color reaction of hexuronic acids.

DISCHE, Z. *J. Biol. Chem., 167,* 189-198, Jan. 1947.

A new, specific color reaction for hexuronic acids with carbazole and sulfuric acids is described. Reaction is positive with a solution of glucuronic acid containing 5 to 100 γ per cc. Up to 20 times the concentration of proteins does not interfere greatly.

194G. The determination of different sugars in aqueous extracts of rye milling products in connection with amylolysis.

HINTZ, H. M. R. *Rec. Trav. Chim., 65,* 685-90 (1946); *Chem. Abst., 41,* 2502b, Apr. 20, 1947.

Directions are given for the determination of glucose, fructose, maltose, and reducing dextrins in rye meal or flour. The biochemical method of Voorst was used. Maltose was found only in very small amounts (0.01 to 0.05%) in contradiction to earlier reports.

195G. Starches and starch fractions. I. The determination of dextrose and maltose by the ferricyanide-carbonate reagent, with special reference to the effect of inorganic salts.

LAMPITT, L. H., *et al. J. Soc. Chem. Ind., 66,* 68-73, Mar. 1947.

The oxidative power of the ferri-cyanide-carbonate reagent towards dextrose and maltose is decreased by the presence of sodium chloride and sodium acetate, in quantities such as would be present after the hydrolysis of starch by hydrochloric acid or by β-amylase in the presence of an acetic acid-sodium acetate buffer. The oxidative power of the reagent is lowered by exposure to diffuse daylight and possibly also by prolonged storage in the dark.

196G. Chemical determination of niacin.

MULLER, A. AND FOX, S. H. *J. Biol. Chem., 167,* 291-2, Jan. 1947.

Method is based upon the yellow color obtained by reacting nicotinic acid with cyanogen bromide and ammonia buffer. Color has an $E^{1\%}_{1cm.}$ of 4500 to 4600 with maximum at 410 mμ. Concentration of 1 to 15γ per ml. is used. Advantages claimed are greater sensitivity, precision and rapidity.

197G. Determination of thiamine and riboflavin in the presence of reduced iron.

DE RITTER, E., AND RUBIN, S. H. *Anal. Chem., 19,* 343-8, Apr. 1947.

Reduced iron causes partial destruction of thiamine and riboflavin during acid extraction of certain vitamin-mineral concentrates, like flour premixes, in which relatively large amounts of iron are incorporated. The effect is not noted in flour enriched with this type of premix nor in premixes containing ferrous or ferric iron. The effect can be avoided by extracting at room temperature with acetate buffer at pH 6 or by adding cystine to the acid extractant, if hot extraction is required.

198G. Determination of DDT, particularly in milk and fats, by the Schechter procedure.

CLIFFORD, P. A. *J. Assoc. Off. Agr. Chem., 30,* 337-49, May 1947.

No more than 100 mg. of organic residue should be present for the successful completion of the nitration step in the Schechter colorimetric procedure for the determination of DDT. A method in which DDT is isolated from fatty samples by means of a lipolitic hydrolysis is described, and its applicability to samples of milk and butterfat shown.

199G. Ratio of labile chlorine to total chlorine in DDT spray-residue deposits in southern Indiana apple orchards.

FAHEY, J. E., RUSK, H. W. *J. Assoc. Off. Agr. Chem., 30,* 349-54, May 1947.

Total chlorine and/or labile chlorine analysis proved a satisfactory basis for the estimation of DDT in spray residues on fruit of known history.

200G. Colorimetric determination of free chlorine with methyl orange.

TARAS, M. *Anal. Chem., 19,* 342-3, May 1947.

Free chlorine in water can be determined colorimetrically by the addition of methyl orange, since elementary chlorine bleaches methyl orange in the definite ratio of 2 molecules of chlorine to 1 of methyl orange.

201G. The determination of chlorides in commercial feeding stuffs.

FRAPS, G. S., BROWN, E. E. *J. Assoc. Off. Agr. Chem., 30,* 370-2, May 1947.

Chlorides in commercial feeds are determined by ashing with nitric acid in the presence of excess silver nitrate. After ashing is completed the silver nitrate is back titrated with standard ammonium thiocyanate.

202G. The composition of flaxseed mucilage.

ANDERSON, E., AND LOWE, H. J. *J. Biol. Chem. 168,* 289-297, Apr. 1947.

A rapid method for preparing the free acid of flaxseed mucilage, linseed acid, directly from the seed is described. Analysis of flaxseed mucilage and linseed acid shows that they are composed of molar equivalents of d-galacturonic acid, l-rhamnose, l-galactose, and d-xylose. During hydrolysis of the mucilage d-xylose is the first and l-galactose the second sugar to be liberated. An improved method for preparing l-galactose from the mucilage is described. Flaxseed mucilage seems to be the salt of a polymerized aldotetronic acid composed of molar equivalents of d-galacturonic acid, l-rhamnose, l-galactose, and d-xylose. The physical properties of the mucilage suggest that it has a branched chain structure.

203G. A modified method for the determination of monoglyceride in fats and oils by oxidation with periodic acid.

HANDSCHUMAKER, E., AND LINTERIS, L. *J. Am. Oil Chem. Soc., 24,* 143-5, May 1947.

A modification of the Pohle *et al.* [*Oil & Soap 22,* 115 (1945)] to yield more accurate results in routine analyses.

204G. The determination of the peroxide values of edible fats and oils. The iodimetric method.

LEA, C. H. *J. Soc. Chem. Ind., 65,* 286-290 (1946); *J. Am. Oil Chem. Soc., 24,* 92, Mar. 1947.

The increase in peroxide value observed in earlier iodimetric procedures when the quantity of fat taken for determination was reduced has been shown to be due to an increasing error resulting from further oxidation of the fat by dissolved O_2 during the determination rather than to loss of I by reabsorption. The effect of other factors, such as moisture in the reagent and time and temperature of reaction, were measured. The data were the bases for development of 2 procedures in which O_2 exclusion was adequate.

205G. A method of estimation of fat (in cocoa and chocolate).

ACKERMAN, F. *Mitt. Geb. Lebensmittel. Hyg. 32,* 12 (1941); *Nutr. Abst. Revs., 16,* 518, Jan. 1947.

A simple extraction tube drawn out finely at the bottom is plugged with cottonwool, which is then covered with a thin layer of sand. Five g. of the material to be analyzed are ground with 5 g. of anhydrous Na_2SO_4 and 5 g. of sand and introduced into the tube. The whole is then percolated with 2 or more successive lots of ether at a rate such that 1 drop passes in 10 sec. The ether is evaporated from the extract in a weighed flask and the residual fat is weighed.

BIOLOGICAL SCIENCES

BACTERIOLOGY

206G. Methylcellulose and bacterial motility.

PIJPER, A. *J. Bact., 53,* 257-269, Mar. 1947.

Solutions of methylcellulose (sold as "methocel" by the Dow Company) provided a particularly suitable medium for the study of bacterial motility. Such solutions possess sufficient viscosity to slow down the movement of otherwise fast-moving bacteria and thus supply conditions for detailed observation of movement, which appears as if it were in "slow motion." The special advantage of methocel over the solutions of gelatin and gum used hitherto for this purpose is that the precipitation of the colloid material on bacterial bodies and appendages is minimal, so that motility is not hindered by this thickening.

207G. Problems and errors in assigning causes of bacterial food poisoning.

DACK, G. M. *Am. J. Public Health, 37,* 360-4, Apr. 1, 1947.

A critical study is made of several outbreaks of food poisoning. There is indication that several bacterial agents have been implicated on the basis of presumptive and inconclusive evidence. The author tabulates 9 such outbreaks with case histories, presumed cause, and critical remarks.

208G. Inactivation of the virus of infectious hepatitis in drinking water.

NEEFE, J. R. *et al. Am. J. Public Health, 37,* 365-372, Apr. 1947.

Experimental procedure and results are presented in the study of inactivation of the virus of hepatitis in water. The treatment of drinking water by coagulation, filtration and application of chlorine under specified conditions is adequate to decontaminate heavily infested drinking water.

209G. Evaluating dishwashing detergents.

TIEDMAN, W. D. *Soap San. Chem., 23,* 48-50, Apr. 1947.

Discusses sanitation problems related to dishwashing in public eating places. Proposed laboratory method using standard food soil on microscope slides is under collaborative study at Univ. of Montana.

210G. Stock organisms for preparing soy sauce.

Soybean Dig., 7, 24, June 1947.

Strains of four organisms desirable in preparing soy sauce have been added to the culture collection of industrial ferments at Northern Regional Research Laboratory at Peoria, Ill. These will include two molds, a yeast, and a bacterium. Pure cultures will be available for industrial users.

BIOCHEMISTRY

211G. Isolation and characterization of vitamin Bc from liver and yeast. Occurrence of an acid-labile chick antianemia factor in liver.

PFIFFNER, J. J. *et al. J. Am. Chem. Soc., 69,* 1476-87, June 1947.

Methods are described for the isolation of crystalline vitamin Bc as the free acid and its dimethyl ester from hog liver. The identical acid and ester were isolated from horse liver. A method is described for the partial concentration of the chick antianemia activity in yeast extract. Following enzymatic digestion of such concentrates the identical acid and ester were isolated. Some salts and derivatives of the vitamin are described. Vitamin Bc was found to be identical with synthetic pteroylglutamic acid. Evidence is presented for the occurrence in liver of a compound having biological properties similar to those of pteroylglutamic acid but differing from it chiefly in being very acid labile.

212G. The effect of nicotinamide on the solubility of riboflavin in water.

FROST, D. V. *J. Am. Chem. Soc., 69,* 1064-5, May 1947.

The solubility of riboflavin in nicotinamide solutions was found to decrease progressively at pH values more acid than 5. At pH 5 riboflavin solubility increased from about 0.1% to about 2.5% with an increase of nicotinamide concentrations from 5 to 50%. The observed strong solvent effect of nicotinamide on riboflavin appears to be related to its chemical constitution; both the pyridine and

amide groups are involved. An acid which forms an additional salt reduces the solvent action of nicotinamide but does not eliminate it.

MICROBIOLOGY

213G. Biological assay of folic acid activity in common feedstuffs.

LILLIE, R. J., AND BRIGGS, G. M. *Poultry Sci., 26,* 289-294, May 1947.

In a study of the quantitative distribution of folic acid in common feedstuffs, by use of a chicken assay, it was found that the cereal grains, grain by-products, and dairy by-products were relatively poor sources of this vitamin. Soybean oil meal, alfalfa meal, and fermentation solubles were relatively good sources, and yeast from several origins and liver meals were excellent sources. A sample of menhaden fish meal did not show any folic acid activity.

214G. A study of the microbiologic assay of riboflavin.

WOODSON, H. W., KIRCH, E. R., AND BERGEIM, O. *Jour. Amer. Pharm. Assoc. Sci. Ed. 35,* 253-255 (1946); *Biol. Abst., 21,* 321, No. 2974, Feb. 1947.

The values determined with a mixture of 20 amino acids compared favorably with those from the customary media containing alkali-treated peptone or casein hydrolyzate. For the riboflavin assay a new test organism, *Lactobacillus delbruckii,* gave essentially the same growth responses as the standard organism, *L. casei.*

215G. Microbiological determination of lysine in proteins and foods.

HORNE, M. J., JONES, D. B., AND BLUM, A. E. *J. Biol. Chem., 169,* 71-6, June 1947.

A microbiological method is described for the determination of lysine in proteins and foods with *Leuconostoc mesenteroides.* The results of assays on 31 proteins and foods agree closely with those obtained by other microbiological methods.

216G. The determination of glycine in protein hydrolysates with Leuconostoc mesenteroides P-60.

SHANKMAN, S., CAMIEN, M. N., AND DUNN, M. S. *J. Biol. Chem., 168,* 51-60, Apr. 1947.

A microbiological assay for glysine in protein hydrolysates is described. The glysine content of casein was found to be 1.9%, somewhat higher than other values reported in the literature.

217G. The Maillard reaction in microbiological assay.

HILL, E. G., AND PATTON, A. R. *Science, 105,* 481-2, May 2, 1947.

The usual microbiological assay technique involves heating solutions containing amino acids and dextrose. The solutions always turn brown. However, when sucrose is used or the dextrose is heated separately from the amino acid, the solutions are "water white." These water white solutions gave better growth curves than the brown ones. The pH change due to browning is only 0.2 but might be a factor affecting the growth curves.

FOOD PRODUCTS

CEREALS AND GRAINS

218G. The enrichment of corn grits with synthetic vitamins and iron.

FURTHER, M. F., *et al. Trans. Am. Assoc. Cer. Chem., 5,* 26-36, Apr. 1947.

Degerminated corn grits have been uniformly enriched with synthetic vitamins and iron in a process which involves the manufacture of a premix as a vehicle for addition of thiamine, riboflavin, niacin, and iron at any practical enrichment levels. This corn grits premix suffers only slight losses of nutrients in customary washing, as tested by the South Carolina and Federal Register tests, and is also resistant to cooking and storage losses. The washing losses from enriched grits are largely determined by the content and washing loss from the untreated grits, both of which have been found to vary widely in various lots of commercial determined grits. The thiamine, riboflavin, and niacin in enriched grits are completely available to humans, as demonstrated by quantitative measurements with a human bioassay technique.

219G. Amylase activity of malts from spring and winter barley as influenced by variety, season and environment.

DICKSON, A. D., OLSON, W. J., AND BURKHART, B. O. *Am. Soc. Brew. Chem., 11,* 13-8 (1946); *Chem. Abst., 41,* 2531f, Apr. 20, 1947.

Eleven varieties of barley malts from 1942-45 crops were studied. In general it was shown that commonly grown varieties showing high β-amylase activity also showed comparatively high α-amylase activity with two exceptions, Trebi and Tregal varieties. The plant breeder could produce considerable variation for industrial use but additional information on industrial malt requirements is needed.

COFFEE AND TEA

220G. Roasted coffee and oxygen.

PUNNETT, P. W. *Tea Coffee Tr. J., 92,* 12, 26-9, May 1947.

The study reported indicated a rapid absorption of oxygen by coffee during the first 20 days, causing a loss of flavor and formation of staleness; a slow absorption during the next 6 months; a rapid absorption during the next 8 to 10 months, causing rancidity of the oil; and a slow absorption during the next several years.

221G. The catechins of green tea. I.

BRADFIELD, A. E., PENNEY, M., AND WRIGHT, W. B. *J. Chem. Soc.,* 32-36, Jan. 1947.

From the polyphenol fraction extracted from a green-tea infusion by ethyl acetate, l-gallocatechin and a substance, $C_{15}H_{14}O_7$, H_2O, probably dl-gallocatechin, have been isolated by partition chromatography.

DEHYDRATED FOOD

222G. Pectinic acids as related to textures and quality of dehydrated fruit products.

BAKER, G. L., AND MURRAY, W. G. *Food Res., 12,* 129-132, Mar.-Apr. 1947.

The grade (as calculated from viscosity) of pectins present in dehydrated products may be an index of their quality. A straight line relationship was found in the case of apples and peaches but not apricots. Dehydrated carrots, apparently can be graded in this manner.

223G. Mashed potato powder. III. The high-temperature browning of mashed potato powder.

BURTON, W. G. *Jour. Soc. Chem. Ind. (London) 64,* 215-218 (1945); *Biol. Abst., 21,* 455, No. 4315, Feb. 1947.

Rate of development of brown color increases rapidly with temp. and moisture content when these are above 25° and 5%, respectively. Increasing pH increases the rate of browning. Browning is accompanied by production of CO_2 and loss of hexose sugars and possibly amino-nitrogen. Substances capable of reacting with the aldehyde or ketonic groups in hexose sugars may retard browning.

224G. Palatability and vitamin retention in large scale food preparation of dehydrated sulphited potato strips.

GLEIM, E. *et al. J. Am. Diet. 23,* 322-329, Apr. 1947.

The palatability and the ascorbic acid and niacin retentions were determined in sulphited dehydrated potato shreds during four methods of large scale preparation and three methods of holding of the cooked potatoes warm for serving. The palatability and vitamin retention during cooking the potatoes after storage for four months at room temperature was also determined. The dehydrated potato strips contained on the dry basis an average of 81 mg. of ascorbic acid and 5.7 mg. of niacin per 100 gm. The stored potatoes contained about one third less ascorbic acid and about the same amount of niacin. These potatoes contained so little thiamine, .046 mg., and riboflavin, .040 mg., per 100 gm. on the dry basis that the retention was not studied.

FATS AND OILS

225G. The acid degree, free volatile fatty acids, and the flavor score of salted commercial butters.

KOSIKOWSKY, F. V. *et al. J. Dairy Sci., 30,* 211-221, Apr. 1947.

The existence of a possible relationship between butter quality and free fatty acid concentration, including those of a volatile nature, was investigated. Methods involved included the Knaysi-Guthrie method on butterfat, a titration method for acid degree, and a modified ether-extraction direct-distillation technic for free volatile fatty acid concentration in butter and butterfat. On the basis of the data obtained, it would not be advisable to recommend using either the free total acidity or the free volatile fatty acid values of butter as an index for determining flavor scores of salted commercial butters, due chiefly to variation of individual samples from the averages. For a rough classification of commercial butters as excellent, good, fair, or poor, the use of free volatile acid values might have merit. However, the accumulation of much more data would be required before even this rough classification could be established.

226G. Urease activity and other chemical criteria as indicators of inadequate heating of soybean oil meal.

BIRD, H. R. *J. Assoc. Off. Agr. Chem., 30,* 354-64, May 1947.

The urease activity of soy-bean meals, measured by determining the increase in pH of urea in buffered solution incubated with the meal for ½ hour at 25-30° C., may be used to indicate meals which have been undercooked. Determinations of thiamin and of water-insoluble nitrogen may also be used to indicate undercooking.

227G. Studies on solvent fractions from fish liver oils.

BUXTON, L. O. *J. Am. Oil Chemists, 24,* 107-116, Mar. 1947.

Fish liver oils were fractionated using 91, 95, and 99% isopropanol, 95% acetone and 100% methanol. These extracts had higher vitamin A content than the original oils as well as higher unsaponifiable fraction and free fatty acids. The isopropanol and acetone treatment removed all of the antioxidants from the oil. Stability tests indicated that vitamin A to be protected to peroxidation by these antioxidants decomposed in the solvent. At higher temperatures (50 and 65° C.) the peroxides decomposed nearly as rapidly as they were formed. The studies indicate that the major antioxidant in fish liver oil is not of a tocopherol type. Vitamin A is lost with peroxidation of fats.

228G. The kinetics of the oxidation of several antioxidants in oxidizing fats.

LUNDBERG, W. O., DOCKSTADER, W. B., AND HALVORSON, H. O. *J. Am. Oil Chem. Soc., 24,* 89-92, Mar. 1947.

The deterioration of hydroquinone, catechol, NDGA (nordihydroguaiaretic acid), and gallic acid in lard oxidizing at 100° C. has been quantitatively studied. Initial concentrations of 0.02, 0.1, and 0.5% were used. The results indicate that, in general, the deterioration of phenolic antioxidants in oxidizing fats does not occur as a single low order reaction but is complicated by products formed in the oxidation of the fat and possibly also of the antioxidant. The deterioration curves for gallic acid are quite different from those of the other three antioxidants. This is tentatively explained on the basis of the synergistic action of gallic acid upon itself. There is an increasing catalytic effect with increasing initial concentrations of all of these antioxidants on the formation of peroxides during the early stages of the autoxidation of lard.

FROZEN FOOD

229G. An evaluation of food freezing methods.

MEEK, G. W., AND GREENE, V. R. H. *Food Freezing, 2,* 471-5, June 1947.

Three aspects of methods of freezing foods are discussed: (1) the important freezing methods or systems used; (2) the factors which should determine the freezing systems most applicable and satisfactory for a certain set of conditions; (3) the use of these factors in comparing the performance of the systems discussed.

230G. The preparation of peaches for freezing. Part I.

WOODROOF, J. G. *et al. Food Freezing, 2,* 403-5, May 1947.

An analysis of the following steps in processing and freezing freestone peaches is given: selecting the fresh fruit, sorting, peeling, washing, acid rinsing of lye-peeled fruit, pitting and trimming, slicing, adding sugar and preventing browning, packaging, freezing and inspecting the finished product.

231G. The preparation of peaches for freezing. Part II.

WOODROOF, J. G. *et al. Food Freezing, 2,* 495-8, June 1947.

Lye peeling of peaches is preferred to hand or steam peeling. The Draper-type and lye-spray are the most important types of scalders in use. There was improvement in peeling and washing when the peaches were pre-wet in water before being placed in the lye bath. It was apparent that pre-wetting the peaches in water, defuzzing by brushing or rubbing the peaches either wet or dry, or increasing the external temperature of the peaches gave a smoother peel and cleaner wash. Wet peaches put into the lye bath immediately after removal from cold storage, at 34° F., require 25% longer treatment, had 37% greater peeling loss, and required 86% more lye than similarly-treated peaches at room temperature of 85° F. By heating the peaches to 150° F. before placing them in the lye bath, efficiency of peeling and washing was increased 20%, but slightly more lye was used.

232G. Air blast tunnels common northwest freezing method.

KNOWLES, F. W. *West Can. Pack., 39,* 74, June 1947.

A review of the freezing tunnel types and construction. Operation and costs are also discussed.

233G. Microbiological aspects of frozen precooked foods.

PROCTOR, B. E., AND PHILLIPS, A. W. *Refrig. Eng., 53,* 30-33, Jan. 1947.

The data presented indicate that not all frozen precooked food products being manufactured and sold today are subject to either constant or strict bacteriological control. There is no other satisfactory way of determining quality standards for certain of these products. Such control is not only desirable; it is essential for the protection of both the consumer and the producer. The direct microscopic method of bacteriological evalua-

tion has been found to be of great value in checking the sanitary quality of these products, and presents for frozen food manufacturers a means of rapid continuous control over the microbiological quality of raw materials, food in process, and finished product. It should be supplemented by the more common plate count technique at frequent intervals. The use of some method of coding packaged products of this character in order that different lots or production dates can be identified is strongly recommended as a continuing assistance to quality control.

234G. Effect of stabilizers on frozen cream.

BELL, R. W. *J. Milk & Food Tech., 10,* 149-57, May-June 1947.

Two stabilizers, emargol and fruit pectin, were investigated to determine if it is possible to make thawed cream resemble bottled whipping cream. Emargol gave a slightly foreign flavor in proportion to the amount added and little was gained: practically no significant changes in viscosity of the thawed creams was noted. The thawing period was shortened and the consistency of the cream improved. Pectin gave greater viscosity, smoother texture and there was less tendency to form cream plugs in thawed creams, similar to emargol. Both pectin and emargol aided in stabilizing raw cream during low temperature storage. The size of the fat globules, avoidance of clumping and rate of freezing and storage temperature seem to be more important.

FRUIT AND FRUIT JUICE

235G. Citrus fruit phosphatase.

AXELROD, B. *J. Biol. Chem., 167,* 57-72, Jan. 1947.

The enzyme hydrolyzes a variety of phosphate compounds. It is found in navel and Valencia oranges, Eureka lemons and Marsh grapefruits. Its relative concentration was determined in the various tissues and in the juice, also its stability at various pH levels. The orange juice phosphatase can hydrolyze phosphomonoesterase and various polyphosphates.

236G. Method of and apparatus for extracting juice from whole citrus fruit.

PETERSON, R. E., assignor to Food Machinery Corporation, 2,420,681, May 20, 1947.

A method of extracting juice from a whole citrus fruit which comprises: forming a hole in the rind of the fruit, applying uniform compressive forces through a fluid medium to closely spaced points in all areas of the rind outside the area of the hole, to support the rind of the fruit against local outward bursting, and increasing the pressure of the fluid medium to decrease the volume of the space within the boundaries of support and thereby force the juice from the fruit out of the hole.

237G. Method of and apparatus for extracting juice and peel oil from whole citrus fruit.

PIPKIN, W. A. 2,420,679, May 20, 1947.

A citrus fruit juice extractor the combination of: a pair of fruit supporting and compressing cups the walls of which are slotted to permit interdigitation when cups are brought together; means for bringing cups together to enclose and support and compress a whole fruit, cups being shaped to cause fruit to conform thereto whereupon cups support the rind of fruit at a multiplicity of points sufficiently closely spaced to prevent outward bursting of the juice-bearing structure excepting in a given restricted area; and juice passage means are adapted to provide within the aforesaid area a passageway from fruit through which the juice may flow out of the fruit when the fruit is enclosed and compressed.

238G. Peel oil and juice extraction by fluid pressure.

PIPKIN, W. A. 2,420,680, May 20, 1947.

A method of extracting juice and peel oil from a whole citrus fruit which comprises: forming an opening in the rind of the fruit for the escape of juice therefrom, substantially surrounding fruit medium, applying compressive forces through said medium uniformly to closely spaced areas of the entire surface of the rind outside the area of the opening to squeeze the juice therefrom out of the opening and to press peel oil from the exterior surface of the rind, and separately collecting the juice and peel oil.

MEAT

239G. Relation of tenderness of beef to aging time at 33-35° F.

DEATHERAGE, F. E., AND HARSHAM, A. *Food Res., 12,* 164-172, Mar.-Apr. 1947.

Changes in tenderness of beef carcasses during aging at 33-35° F. were determined by estimating after various intervals of time the tenderness of the respective longissimus dorsi muscle by subjective testing of broiled steaks. Tenderness curves indicate that at 24 days there is a drop in tenderness after a period of progressive increase. At 31 days there is some improvement over the 17 day level.

240G. Toxicity of certain salts of sodium and potassium for swine.

GWATKIN, R., AND PLUMMER, P. J. G. *Canad. J. Comp. Med. 10*, 183-190 (1946); *Nutr. Abst. Revs., 16*, 740, Jan. 1947.

Two pairs of pigs weighing 80 to 88 lbs. were given 0.25 or 0.5 lb. of NaCl daily for two months. Two animals were given the NaCl with their food and had fresh water to drink; the others were given NaCl in water which was used both for mixing the food and for drinking. The concentration of NaCl in the former case was higher, and both the animals became extremely nervous. The two animals given 0.5 lb. NaCl daily were killed and showed catarrhal tubular nephritis and degeneration of the liver cells. A fasting pig weighing 75 lbs. given 1 lb. NaCl in 1225 ml. of water died about 12 hrs. later and showed acute gastritis and oedema of the stomach wall. These findings suggest that under ordinary conditions of pig husbandry, NaCl poisoning is very unlikely to occur.

PECTIN

241G. Pectic substances and methods for their preparation.

BRYANT, E. F., assignor to California Fruit Growers Exchange, 2,419,883, Apr. 29, 1947.

A process which comprises subjecting pectous source materials to pectation to produce a fibrous pectate pulp, washing the pectated pulp to remove water-soluble constituents therefrom, leaching the washed pulp with an acid to remove metallic ions capable of forming insoluble pectates, and subsequently washing the leached pulp to remove excessive acidic reagent and soluble components therefrom.

A pectous material comprising a cellulosic pulp having distributed therein fibrous pectic acid, the pulp being substantially free from metallic ions capable of forming insoluble pectates, and being dispersible in cold aqueous alkalis.

242G. An X-ray diffraction investigation of pectinic acids.

PALMER, K. J. *et al. J. Physical Colloid Chem., 51*, 710-20, May 1947.

X-ray diffraction patterns of pectinic and pectic acids in the form of powders and fibers were obtained and the interplanar spacings recorded. The variation in spacings with methoxyl content has been determined. A fiber identity period of 13A, has been found for the polygalacturonide chain in all the pectic and pectinic acids studied. The interchain separation increases from about 6.6 to 6.94A. when the methoxyl content varies from 0 to 11%. Pectic and pectinic acids show a negative birefringence whereas fibers of alginic acid and sodium alginate are positive. A structural reason for negative birefringence is suggested.

243G. New device for grading pectins.

OWENS, H. S., PORTER, O., AND MACLAY, W. D. *Food Ind., 19*, 606-8, May 1947.

The jelly grade of a number of pectins has been determined with three instruments and two media. Of the testers used, the rigidometer is the most rapid and precise, yields values for the modulus of rigidity or shear modulus, and requires only one calibration curve for all types of pectin gels. The sagometer which measures percentage sag of a gel is rapid and precise, and can be calibrated against the rigidometer to give values for the shear moduli. The Tarr-Baker tester, which measures breaking strength by force on a plunger, gives an indication of the brittleness of gels when used in conjunction with one of the other instruments. A shear modulus of 3 g./cm.^{2} was chosen as standard, and the results suggest that it be considered by the pectin industry as a basis for grading their commercial products.

SUGARS AND STARCHES

244G. Toxicity of sweetening substances.

STAUB, H. *Mitt. Geb. Lebensmittel. Hyg., 36*, 7-19 (1945); *Nutr. Abst. Revs., 16*, 662, Jan. 1947.

The physiological actions of two sweetening substances, saccharine and dulcine, are discussed. It is pointed out that saccharine has little or no harmful effect, and from a review of the literature combined with the results of the author's own experiments on the influence of dulcine on certain enzyme systems in human serum, survival of leucocytes and methaemoglobin formation, it is concluded that this substance can be used, within the limits laid down by Swiss law, without harmful effect.

245G. Preparation of caramel, flavor and color.

JACOBS, M. B. *Am. Perf., 49*, 501, May 1947.

An outline of the preparation, properties, and recorded chemistry of caramel flavoring and coloring. A spray-dried caramel powder is described.

246G. Chemistry of potato starch.

HAWORTH, W. N., AND PEAT, S. *Manuf. Chemist, 18*, 118, Mar. 1947.

Pure amylose is obtained readily, but the purification of amylopectin presents difficul-

ties not yet unravelled. A number of esters of these two starch constituents have been prepared and the glycolic esters, which have properties similar to those of alginic acid, may find parallel uses in plastics and fibres.

VEGETABLES

247G. Some factors that influence the yield and quality of peas for canning.

Canner, 105, 12-4, July 5, 1947.

A uniform series of trials were conducted at the Davis County Experimental Farm in 1943, 1944, 1945 on the influence of maturity on the yield, tenderness, starch and ascorbic acid content of canning peas. Comparisons of the currently used grading methods and price schedules were also made. The results indicated an increase in yield as the peas advanced in stage of maturity above a tenderometer value of 85. However, the unit increase was greater below a tenderometer value of 102 than it was above this point. The starch content increased as the peas advanced in maturity. The increase was proportional to the increase in tenderometer value. The vitamin C content of fresh peas of either variety gradually decreased with increased maturity. In these studies the tenderometer machine proved to be an excellent method of grading but the price to the grower for the various grades should be so adjusted that the better quality peas will give a greater acre return.

248G. Chlorogenic acid and respiration of sweet potatoes.

RUDKIN, G. O., AND NELSON, J. M. *J. Am. Chem. Soc., 69,* 1470-5, June 1947.

Two substances have been isolated from sweet potatoes. One of these has been shown to be chlorogenic acid, and the other to be closely related to chlorogenic acid. It has been shown that chlorogenic acid and the other phenolic compounds, can play the role of a hydrogen carrier next to the terminal oxidase in a respiratory chain of the sweet potato.

INDUSTRIAL CHEMISTRY

249G. Industrial wastes.

Ind. & Eng. Chem., 39, 559-676, May 1947.

Twenty-two articles and a bibliography of several hundred more comprise this entire issue of Ind. Chem. Of particular interest are 6 papers on wastes from food plants including dairy, canning, citrus, cornstarch processes.

250G. Effluent disposal in the food industry.

BRIDGEWATER, N. P., AND TAYLOR, A. *Food Manuf., 2,* 127-131, Mar. 1947.

Treatment and disposal, physical methods, use of chemicals for coagulation, and biochemical methods, of disposal are covered. Waste disposal in specific industries such as dairy, sugar manufacturing, canning and dehydrating are discussed.

251G. Industrial waste disposal.

BARNES, *G. E. Mech. Eng., 69,* 465, June 1947.

The general aspects of stream pollution and domestic sewerage and sewage treatment are outlined as background material for an understanding of the problems encountered in the handling of industrial wastes. An overall picture is presented of the nation-wide scope of industrial waste pollution with particular emphasis on the critical situation throughout the industrial Midwest. Some typical wastes are described by population equivalent or other characteristics; their deleterious character is explained; and the manner in which treatment may be effected in some typical or selected cases is given. Atmospheric pollution is not discussed. Trends in the division of responsibility and for the division of cost between industry and municipalities in the matter of handling and treating industrial wastes are touched upon. There are some general observations on recovery aspects and on pertinent engineering matters.

NUTRITION

252G. The role of B_6-deficiency in the tryptophane-niacin relationship in rats.

ROSEN, F., HUFF, J. W., AND PERLZWEIG, W. A. *J. Nutr., 33,* 561-7, May 1947.

The omission of pyridoxine from the diet of rats results in a progressive decrease in the urinary excretion of N^1-methylnicotinamide after doses of tryptophane. This defect is only slightly overcome by the restoration of pyridoxine to the diet. The data indicate that the abnormal formation of xanthurenic acid in B_6 deficiency is not responsible for the impaired tryptophane to niacin transformation.

253G. Purified rations and the requirement of folic acid for foxes.

SCHAEFER, A. E., WHITEHAIR, C. K., AND ELVEHJEM, C. A. *Arch. Biochem., 12,* 349-57, Mar. 1947.

Feeding tests with purified diets indicated that foxes require 25γ of folic acid/100 g. of ration. Five hundred γ of folic acid per daily

feeding is required by the fox to recover from symptoms of folic acid deficiency. Folic acid conjugate contained in yeast is not utilizable by the fox. The tests also indicated that fresh liver contains an unknown factor necessary for normal nutrition of foxes.

254G. Tissue reserves of ascorbic acid in normal adults on three levels of intake.

HAINES, J. E., *et al. J. Nutr., 33,* 479-89, Apr. 1947.

Three levels of ascorbic acid intake were used in diets to study the ascorbic acid metabolism of normal diets. An experimental period of six weeks was used. On the National Research Council allowance of 70 mg./day, there was only slight depletion of tissue stores. With an intermediate diet of from 50 to 53 mg., moderate depletion occurred, while on a diet of 33 mg. (League of Nations Standard) rather marked depletion took place.

255G. Nutritive aspects of the amino acids.

DORN, H. W. *Bull. Nat. Formulary Comm., 15,* 41, Mar.-Apr. 1947.

This is a comprehensive review of the subject, including its history. Fifty-seven references.

256G. Amino acids in nitrogen metabolism with particular reference to the role of methionine.

BRUSH, M., WILLMAN, W., AND SWANSON, P. P. *J. Nutr., 33,* 389-410, Apr. 1947.

Whole eggs, introduced into a protein-free diet led to a depression in the excretion of urinary nitrogen in rats. Equivalent quantities of nitrogen in the form of the ten essential amino acids, have as definite an effect as eggs at a level of 3.5% dietary protein. Methionine is the most powerful amino acid in sparing body nitrogen, although a mixture of essential amino acids is more effective than any individual one.

257G. Amino acids excreted by mice fed incomplete proteins.

PEARCH, E. L., SAUBERLICH, H. E., AND BAUMANN, C. A. *J. Biol. Chem., 168,* 271-82, Apr. 1947.

The results of microbiological assays indicate that mice fed diets containing incomplete proteins excrete an average of 24.5% of the ingested amino acids in the urine, as compared to an average of only 2.9% excretion of ingested amino acids when a complete protein was fed.

258G. Amino acid content of feeds. I. Leucine, valine, isoleucine and phenylalanine.

SCHWEIGERT, B. S. *J. Nutr., 33,* 553-9, May 1947.

The leucine, valine, isoleucine and phenylalanine contents of various feed materials have been determined by the use of microbiological methods. Values for these amino acids in different lots of corn, corn gluten meal, alfalfa leaf meal, milo and soybean oil meal were quite uniform. More variability was observed between different samples of meat and bone scraps. The differences between the amino acid content of 2 rations calculated from data on individual ingredients and determined by actual analysis were within $\pm 7\%$.

259G. The value of meat and peas, alone or in combination, as a source of protein for growth.

LEHRER, W. P., WOODS, E., AND BEESON, W. M. *J Nutr., 33,* 469-77, Apr. 1947.

Cooked pork, lamb, beef and peas were used as sources of protein for young rats. Their effect on growth was compared with that of whole eggs. Meat fed at 10% protein level was as adequate as whole eggs for growth. Peas were found to be poor sources unless supplemented with 0.3% dl-methionine. The levels of meat used in combination with peas were found to be unsatisfactory.

260G. A comparison of the nutritive value of the proteins in mixed diets for dogs, rats, and human beings.

HEGSTED, D. M. *et al. J. Lab. Clin. Med., 32,* 403-409, Apr. 1947.

Human subjects, rats, and dogs have been used to determine the biologic value of proteins in natural diets. The rat appeared to react in an exactly comparable manner to the human being when meat was added to the diet. Digestibility was not improved but the biologic value was increased 10%. With the dog, on the other hand, both digestibility and biologic value were improved by meat supplementation. The rat in these studies appeared more comparable to the human being than the dog.

261G. Protein requirements of adults.

HEGSTED, D. M. *et al. Jour. Lab. and Clin. Med., 31,* 261-284 (1946); *Biol. Abst., 21,* 317, No. 2921, Feb. 1947.

N balance studies in 26 healthy adults on low protein diets showed that the requirement is more closely related to surface area than to body wt., and is about 2.9 g. N (18 g. protein)/sq. m. If protein is supplied, 2/3 from vegetables and 1/3 from meat, the require-

ment is reduced to 2.4 g. N./sq. m. In the presence of adequate caloric intake it is unlikely that protein deficiency will develop if the diet is cereal and vegetable. The standard protein allowance of 70 g./day can safely be reduced to 50 g. for healthy adults.

262G. The nutritive value of nuts.

MELVILLE, R. *Chem. & Ind.*, No. 22, 304-5, May 31, 1947.

Analytical data on starch, fat, protein and vitamin content of 60 varieties of nuts. General discussion on the part nuts play in diet of peoples of the world.

263G. Nutritive value of keratin. III. Effect of source, particle size, and method of grinding.

NEWELL, G. W., AND ELVEHJEM, C. A. *J. Nutr., 33,* 673-83, June 1947.

Finely powdered keratins have been studied as possible protein sources for growing rats and chicks. When chicks or rats were fed purified ration which contained 30-40% of powdered hoofs, substantial growth was obtained. High levels of powdered hog hair in chick rations allowed moderate growth but usually produced an encephalomalacia unless sources of vitamin E were present. Powdered chicken feathers allowed only poor growth. In general, the rates of growth obtained with chicks and rats fed rations containing these keratins show a positive correlation with the degre of subdivision of the keratin.

264G. The nutritive value of yeast, beer, wines and spirits.

BUNKER, H. J. *Chem. & Ind., 16,* 203-5, Apr. 19, 1947.

Analytical data on nutritive constituents of yeast, beer, wines and spirits are given. There are 31 references.

265G. Some observations on the nutritional value of dialyzed whey solids.

DANIEL, F. K., HARVEY, E. H. *J. Nutr., 33,* 429-36, Apr. 1947.

Mineral constituents of undialyzed whey cause its low nutritional value. Dialyzed whey lactalbumin substituted for 53% of casein in diets, results in better conversion of food to body tissue in the rat. The comparison was made with rats on a corresponding diet containing milk proteins only.

266G. The nutritive value of margarine and edible oils.

WILKINSON, H. *Chem. & Ind.*, No. 19, 256, Mar. 10, 1947.

Analytical data and discussion, on physiological availability, energy values, and vitamin contents of margarine and edible vegetable oil.

267G. The nutritive value of fresh fruits and fruit juices.

CHARLEY, V. L. S. *Chem. & Ind.*, No. 17, 220-4, Apr. 26, 1947.

Analytical data are given on nutritive constituent of fruits (fresh, dried, canned) and fruit juices.

PHYSICAL CHEMISTRY

268G. Effect of electrolytes on the foaming capacity of alpha soybean protein dispersions.

PERRI, J. M., AND HAZEL, F. *J. Physical Colloid Chem., 51,* 661-6, May 1947.

The effects of electrolytes and of hydrogen-ion concentration on the foaming properties of alpha soybean protein dispersions have been investigated. At low concentrations the valence of the cation had a marked effect on foam formation in the series potassium chloride, calcium chloride and lanthanum chloride. Lyotropic effects were noted with anions and cations. The hydrogen-ion concentration greatly influenced the foaming capacity with a maximum at the isoelectric point, pH 4.1, and minima at pH 3.15 and pH 8.8.

269G. The use of the spherometer in tests on hydrogen swells.

ADAM, W. B. *Ann. Rept. Fruit and Vegetable Preservation Res. Sta. Campden, 19,* 34-39 (1943); *Biol. Abst., 21,* 411, No. 3883, Feb. 1947.

A method is described for determining the rate of fall of vacuum in A-1 tall cans stored at a constant temp. It consists of periodic spherometer readings of the depression of the ends of the cans. The rate of change of depression can be converted into the rate of loss of vacuum, a change of 0.001 in. depression being equivalent to a change of 0.8 in. vacuum. The advantage of the method is that only a few cans need be used and comparative results can be obtained after the vacuum has fallen by 2 or 3 in. instead of by 12-18 in. as in normal tests on H_2 swells. The method is capable of recording readings to an accuracy of about 0.0006 in. As the rate of change in depression of the ends of vegetable cans is generally constant it is evident that the rate of formation of H_2 is also constant.

270G. Low temperature WVT.

PIERCE, S. W., AND HELMS, J. F. *Modern Pack., 20,* 161-4, Apr. 1947.

A method for determining water-vapor-transfer rates at freezing temperatures is described.

271G. The infrared direct reading moisture tester.

BROCK, R. B. *Chem. & Ind.*, No. 22, 299-302, May 31, 1947.

The rate of moisture expelled from various materials by infrared light was complete in from four to eight minutes. The temperature of the sample never rose above 70° F. Materials tested included bran, fiber, flour, malt, oils, leather and organic compounds, with 0.1% error. The balance mechanism consists of an unequal arm with the pan support above the beam as a single rod passing through the floor to the heating chamber. Below this hangs a counterpoise piston in a damping chamber. A rider mechanism with a vertical pointer allows a moisture reading direct from the scale.

272G. Micromanipulative studies on gelatinized starch granules.

COX, M. J., AND MACMASTERS, M. M. *Plant Physiol., 21*, 459-66 (1946); *Brit. Abst.*, BIII, Feb. 1947.

The ability of individual granules of maize, tapioca, and potato starch to stretch without breaking was not correlated with the length of the paste, nor with the paste η. When identical maize starch samples were pasted at const. temp. for 10, 30, and 60 min., and for 72 hours, the degree of stretch was significantly greater in samples pasted for 30 min. than in the others. The % stretch was not appreciably changed by pretreating the starch with 0.2% of SO_2 or $\frac{N}{32}$ NaOH, although the treatments caused decrease and increase, respectively, in the paste η.